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The Archives of Ophthalmology is a bi-monthly journal, published in annual volumes of about six hundred pages each, extensively illustrated with cuts in the text, half-tone text plates, and lithographic plates, many in colors.

About three quarters of the space is devoted to original papers, and the remaining quarter to a systematic report on the progress of ophthalmology, and to reports of societies, book reviews, and miscellaneous notes, all of it original.

The papers and reports are original, and only accepted with the understanding that they are to be published in this journal exclusively. The original papers in the English edition appear in the German (*Archiv für Augenheilkunde*) either in full or in more or less abridged translations, and *vice versa*. Any subscriber who wishes to refer to the original text of a translated or abridged paper may, by applying to the editors, obtain a reprint which he is expected to return after perusal. The subscription price of the ARCHIVES OF OPHTHALMOLOGY is $5.00 per year payable in advance. The price per number is $1.00.

The ARCHIVES is sent postage free in the United States, Canada, Mexico, Cuba, and our insular possessions.

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ARCHIVES OF OPHTHALMOLOGY.

THE EYE IN NERVOUS DISEASE.

An Introduction to Neurological Ophthalmology, Prepared for the N. Y. Neuro-Surgical School for Army Medical Officers.

By WARD A. HOLDEN, M.D.

(With three figures on Text-Plates XI.–XIII.)

IN the routine examination of the eyes of a patient with nervous disease or injury, we wish to determine particularly the following points:

(*a*) The sensibility of the cornea.
(*b*) The size, shape, and reactions of the pupils.
(*c*) Any abnormalities of the extrinsic ocular muscles—nystagmus, spasm, squint, or paralysis.
(*d*) The acuteness of distant and near vision and the fields of vision.
(*e*) The condition of the optic disc as respects atrophy, edema, or alterations in the blood-vessels.
(*f*) Other anomalies such as exophthalmos, retraction of the eyelids, and evidences of existing or previous inflammation, injury, or operation.

The methods of conducting these examinations and the neurological significance of the results obtained will be taken up seriatim.

CORNEA.

The *sensibility* of the cornea is tested most conveniently by touching the cornea with a bit of absorbent cotton twisted

into a thread. Since certain patients shrink from this test, it is well to touch the cheek first and ask the patient if he feels the cotton. Less objection will then be made to touching the cornea itself. In normal conditions when the cornea is touched the patient will wink and also give evidence of feeling some discomfort. The neurotic patient may jerk away as if he had been burned with a hot iron, but this reaction is due more to fear than to actual pain.

In other cases the winking is slow or absent, indicating hypesthesia or anesthesia of the cornea. After section of the ophthalmic division of the fifth nerve, in some cases of herpes zoster of this branch, and after the instillation of cocaine, there is absolute anesthesia of one cornea and touching it causes no winking. Again there may be merely diminished sensibility of one or both corneas. If unilateral, this hypesthesia, without facial hypesthesia, may mean a tumor of the cerebellum on the same side. In such cases there will be also coarse nystagmus to the same side, unstable station, and muscular weakness with a tendency to fall to the same side. Or, hypesthesia of one or both corneas may be a sign of hysteria, when corroborating symptoms may be found, such as anesthesia of the pharynx or other parts, a history of aphonia, or contraction of the fields of vision with normal pupils and optic discs.

Diminished sensibility of one cornea, therefore, means a gross lesion of the fifth nerve of that side, a lesion of the cerebellum of that side compressing the fibers of the fifth nerve, or hysteria.

THE PUPILS.

The pupils in health. The *width* of the pupils is greater in myopic individuals than in hyperopic, and greater in youth than in old age. In adolescence the average width of the pupils in moderate illumination with both eyes open is about 4*mm*, one-third of the width of the cornea. In middle age the average is about 3.5*mm*, while in old age it is 3*mm* or less.

The *shape* of the pupils is round in adolescence, slightly irregular in middle life, and often considerably irregular in old age.

The *reactions* of the pupils are the sensory, the direct light, the consensual light, and the convergence reaction.

The *sensory* reaction consists in a dilatation of the pupils when, for example, the skin of the temple is scratched or the skin of the neck is pinched. While it is usually well marked in early life, in middle age it is inconstant, hence its absence is of very slight diagnostic importance.

The *direct* reaction is the contraction that takes place when light is thrown into the eye observed, and the *consensual* is the contraction that takes place in one eye when light is thrown into the other.

In health, the two pupils are always of equal size, and light thrown into one eye causes a moderate contraction of both pupils, while light thrown into both eyes causes an excessive contraction of both pupils.

The *convergence* reaction is the contraction which occurs when the eyes are brought from distant fixation into convergence and accommodation for near fixation.

The light reactions are well marked in early life, less marked in middle age, and often rather sluggish in old age when the blood-vessels are sclerosed. The convergence reaction is well marked at all ages.

The tests of pupillary reaction may be conveniently made by having the patient sit facing a window at a distance of several feet. If he is then directed to look up at the ceiling, we displace the annoying corneal reflex which ordinarily overlies the pupil and renders it a difficult matter to determine its shape. The eyes are now covered alternately to obtain the consensual light reaction, and next, while one eye is covered the other is alternately covered and exposed to obtain the direct light reaction. The convergence reaction is obtained by directing the patient to fix the observer's finger held near the eyes in line with the point on the ceiling at which he has been gazing.

A finer test that will reveal slight sluggishness is that of throwing light into the eye from a distance with the ordinary ophthalmoscope. The electric ophthalmoscope is unsuited to this test. A common test is that of throwing light into the eye with a pocket electric flash light. This is, however, a coarse test that will fail to discover many sluggish pupils

unless the light is held at some distance from the eye or so held that its rays enter the eye obliquely in order that few of the rays may fall upon the center of the retina.

The pupils in disease. Before considering anomalies of the pupil it is well to call to mind the nerve supply of the iris. The sphincter muscle is supplied by a branch of the 3d nerve which, when stimulated, causes a contraction of the pupil, and when inhibited, causes a moderate dilatation. The radiating arteries of the iris, on the other hand, have their muscular coats supplied by fibers of the sympathetic nerve which, when excited, cause a dilatation of the pupil and, when inhibited, lead to its contraction.

Sympathetic pupillary disturbances: Excitation of the cervical sympathetic causes a dilatation of one or both pupils without visual disturbances and often without the knowledge of the patient. The dilatation is usually transitory and occurs in the neurotic individual, the menstruating woman, or the young girl, following excitement, fatigue, or emotional stress. A more lasting and sometimes permanent disturbance is the contraction of the pupil, usually unilateral, that follows compression of the sympathetic fibers or center.

An injury of the spinal cord involving the cilio-spinal center which lies at the level of the lower cervical and first dorsal vertebræ, or pressure on the sympathetic fibers by an enlarged bronchial gland in tuberculosis, or pressure by cervical glands, or a goiter, may produce a unilateral complex of symptoms consisting of contraction of the pupil, narrowing of the palpebral aperture, and slight sinking of the eyeball into the orbit. Here also there is no disturbance of vision and the patient may not be aware of anything wrong. In doubtful cases, the instillation of 4% cocaine solution will confirm the diagnosis, for cocaine in the normal eye excites the sympathetic nerves and causes dilatation of the pupil and widening of the palpebral aperture. In these cases of pupillary contraction from sympathetic paralysis, cocaine does not dilate the pupil or widen the palpebral aperture in the affected eye, while it has its usual effect in the other eye.

Third nerve pupillary disturbances: Meningeal irritation may cause a spasm of the sphincter muscles with contraction of both pupils. Compression of the nucleus of the nerve for

the sphincter muscle or of its fibers in the 3d-nerve trunk will cause dilatation of the pupil. But, since the nucleus for the sphincter muscle and that for the muscle of accommodation —the ciliary muscle—lie close together and apart from the nuclei for the other muscles supplied by the 3d nerve, and since the fibers for the sphincter and the ciliary muscles run close together in the 3d-nerve trunk, this paralytic dilatation of the pupil is usually accompanied by paralysis of the muscle of accommodation and the patient is unable to see near objects clearly. In these cases, too, the light reaction which is mediated by the 3d nerve is absent, and usually the convergence reaction as well. In the sympathetic pupillary disturbances, on the contrary, the light and convergence reactions are never abolished, although they may be somewhat reduced.

Of clinical interest are the following types:

(*a*) Paralysis of accommodation in each eye with pupils of normal size and reaction often follows diphtheria and lasts a few weeks only.

(*b*) Paralysis of accommodation and dilatation of the pupils with loss of light and convergence reactions in both eyes, without other muscular anomalies, occasionally occurs in ptomain poisoning and is likely to be permanent.

(*c*) The same condition, known as ophthalmoplegia interna, occurring in one eye only and lasting a long time, is almost invariably due to a luetic nuclear lesion.

Argyll-Robertson pupil. Half a century ago, Professor Argyll-Robertson of Edinburgh described a condition in which the light reflex of the pupil is lost while the convergence reflex is preserved, and this he found to be associated with anomalies of the knee jerk, hence, with disease of the spinal cord.

This condition is to be explained by a break in the reflex arc for the light reaction. Fibers from the macular region of the retinas run in the optic nerves and tracts to the primary visual centers, the external geniculate bodies, chiefly, here connecting with the adjacent nuclei for the sphincter muscles of the irides. It is now generally agreed, although not anatomically proven, that the break in the arc must lie in the

fibers connecting the primary visual center with the sphincter nucleus. In support of this view is the fact that non-luetic tumors in the region of the third ventricle by pressure here produce typical Argyll-Robertson pupils.

Our views as to the causation of the Argyll-Robertson pupil, or reflex iridoplegia, and as to its onset and course have become very definite in recent years. Almost without exception it is a symptom of syphilis of the nervous system, and in its incipient stages it appears often within a few months after the initial infection in persons who are to exhibit frank symptoms of syphilis of the nervous system many years later. It begins with slight irregularity and inequality of the pupils, followed by sluggishness of the light reaction. In most cases the pupil gradually becomes contracted to a degree that can be explained by a spasm of the sphincter muscle only and the light reflex is entirely lost. Later, the pupils may become abnormally dilated—in some cases they are large throughout—and with this late dilatation, or before it, the convergence reaction may become sluggish. Vision is never affected by the onset of reflex iridoplegia alone. If near vision is affected, there is absolute iridoplegia with an accompanying paralysis of the muscle of accommodation, namely, an internal ophthalmoplegia.

A certain degree of sluggishness of the pupils, of a transitory nature, is met with in persons who are fatigued or under emotional strain. Hence a second examination is desirable after an interval of rest in such individuals.

EXTRINSIC MUSCLES OF THE EYE.

Nystagmus, spasm, concomitant strabismus, and paralysis are here to be considered.

Nystagmus: When nystagmus dates back to infancy it has no great diagnostic significance. Partial albinism or opacities of the media of the eye may be ocular causes, and difficult labor or hereditary lues may be cerebral causes, giving rise to nystagmus that is mostly constant, but increases when the eyes are moved from the primary position. A slight amount of nystagmus when the eyes are turned far to one

side is fairly constant in the neurotic and the fatigued and may be called physiological.

A well marked nystagmus acquired after infancy always has significance. This may come on with the most diverse intracranial conditions, but certain types have definite significance. First, there may be nystagmus when an ocular muscle is about to be paralyzed or when it is recovering from a paralysis. This nystagmoid twitching is in the direction of the action of the muscle affected and is usually more pronounced in the affected eye than in the other. Nystagmus on looking upward often indicates a midbrain growth and precedes a paralysis of the superior rectus. Marked nystagmus in looking to one side often means a pontine lesion and precedes an associated paralysis of ocular movements to that side. Nystagmus coarse and slow to one side and fine and rapid to the other usually means a cerebellar lesion on the side of the coarse movement. In many cases of disseminate sclerosis there is slight nystagmus in looking straight forward which becomes exaggerated when the eyes are turned in any direction. The matter of aural nystagmus is too considerable to be taken up here.

Spasm: Spasmodic contraction of the orbicularis muscle or of the internal recti producing diplopia is common in hysteria. Spasm of an internal rectus with contracted pupils is often a sign of cerebral irritation, and spasm causing conjugate deviation of the eyes is usually due to pontine irritation.

Concomitant strabismus: When of the convergent variety, this comes on in hyperopes about the age of two years, and when of the divergent variety, it comes on in adolescent myopes. There is here no limitation in the extent of mobility in either eye, but in one eye or both mobility is increased in one direction and diminished in the contrary direction. There is no diplopia. When one eye is blind or amblyopic and is not used for visual purposes, it is apt to turn inward in early life and in adult life outward.

Paralysis: Congenital paralysis due to hemorrhage at birth or malformation of muscles appears immediately after birth. The external rectus is the muscle most frequently involved and a differentiation between convergent strabismus due to a birth palsy of the external rectus or to hyperopia

depends often upon the immediate appearance of the former and the periodic development of the latter at about the age of two years. Next in frequency to birth paralysis of the external rectus is paralysis of one or both superior recti, sometimes accompanied by ptosis. Diplopia is not observed in these congenital cases.

Acquired paralysis of an extrinsic muscle of the eye is revealed to the patient by the existence of diplopia and to the physician by defective mobility of the eye in some direction. Tests for defective mobility, as for nystagmus, are best made by having the patient fix a bright object in the distance and then turn his head from side to side and up and down. This brings out the full excursions of the eyes to all directions and avoids the complication of convergence which comes into play when the patient fixes the finger or other near object.

If there is complete, or almost complete, paralysis of a rectus muscle, simple inspection will reveal the defect. With a slight paresis of a rectus muscle or of a superior oblique, it is necessary to cover each eye alternately, when the affected eye will be found to lag behind if moved in the direction in which the paretic muscle should move it. Thus, for example, with paresis of the right external rectus, there will be no movement of the eyes on alternate covering except when the eyes are turned far to the right when alternate covering will show that the right eye when covered is convergent, Similarly, with paresis of the right superior oblique muscle, the eyes will be balanced under alternate covering except when turned down and to the right, when the right eye if covered will be found to stand higher than the left and to be convergent. After a few weeks a paralytic condition may become complicated by contracture of the muscles antagonistic to the paralyzed muscle, when the status of the muscles must be rather laboriously worked out by holding a red glass before one eye and noting the relative position of the red and white double images of a distant light in all four quadrants of the field of fixation. This test had better be left to the trained ophthalmologist.

The position of the patient's head is often a guide to the muscle paralyzed, for if he does not close one eye to avoid

diplopia he will turn his head to the right and his eyes to the left with paralysis of the right external rectus, and will turn his head down and to the right and his eyes in the contrary direction with paralysis of the right superior oblique, thus increasing the range of mobility in which he sees single.

The *site of the lesion* in ocular palsies is almost exclusively in the nucleus of the supplying nerve or in its trunk. Facial palsy and pseudo-bulbar palsies are frequently due to a supra-nuclear lesion, but since the nuclei of the ocular muscles chiefly have a cortical representation in both hemispheres, practically the only paralyses of supranuclear origin are an occasional ptosis and rarely a transitory conjugate deviation of the eyes.

In order of frequency of involvement, the sixth nerve with its long basilar course is first, then the third nerve in some or all of its branches, and finally the fourth nerve. The sixth-nerve trunk is frequently involved in hemorrhages and exudations at the base of the brain, and a paralysis of both external recti alone is almost necessarily basilar, while paralysis of muscles supplied by both third nerves is usually basilar. In cases of increased intracranial tension from tumor, a paralysis of one external rectus, while the other cranial nerves are spared, is quite common, but this has no great localizing value since it seems to be caused frequently by compression of the nerve trunk by a cerebellar artery (Cushing) and is a sign merely of general increased intracranial pressure.

Destruction of the nucleus of the sixth nerve has more complicated results, since it brings about a paralysis of associated movements to the same side. Disturbance of the middle frontal convolution will cause a spasm or paralysis of associated lateral movements. However, tracts of fibers run from this *cortical* center to the sixth-nerve nucleus which forms the *pontine* and chief center for associated lateral movements, through the association fibers which run in the posterior longitudinal fascicle from the sixth-nerve nucleus of one side to reach the nucleus for the internal rectus of the opposite side. Apoplexy may cause a transitory conjugate deviation from cortical or supra-nuclear pressure, but a permanent inability to turn the two eyes to the right or to the left means a lesion of the sixth-nerve nucleus of the same side. Although

associated lateral movements to one side are thus completely abolished, the affected internal rectus can from another innervation functionate to a considerable extent when efforts at convergence are made.

In cases of nuclear paralysis of the muscles supplied by the third nerve, very frequently the sphincter of the pupil and the muscle of accommodation are spared and the condition is then known as external ophthalmoplegia. When the intrinsic muscles are affected also, the condition is known as total ophthalmoplegia.

Nuclear lesions of the third nerve, as a rule, affect the recti muscles first and the levator of the upper lid later or not at all. Compression of the nerve trunk usually causes ptosis from the beginning and frequently the intrinsic muscles are affected as well as the extrinsic. Pressure on the third-nerve trunk where it lies near the cerebral peduncle produces third-nerve paralysis on the same side and hemiplegia of the opposite side. A lesion in the red nucleus produces a paralysis of the superior rectus on the same side and athetosis of the opposite side of the body.

There are no particular signs by which a nuclear can be distinguished from a trunk lesion of the fourth nerve, except that here, as in the case of other cranial nerves, a trunk lesion may be preceded by meningeal headaches, whereas nuclear lesions may come on without premonitory symptoms. It is not difficult to tell whether there has been an involvement of the fourth nerve in cases of external ophthalmoplegia, because when an effort is made to look down and out, the superior oblique rotates the eyeball slightly down and out if the fourth nerve is intact, while this movement is wanting if the fourth nerve is involved as well as the third.

The acuteness and the fields of vision: Most affections of the optic nerve cause diminution in the acuteness or in the fields of vision, and the nature and extent of recent visual deterioration are often of as great importance in diagnosis as inspection of the optic-nerve head with the ophthalmoscope.

Tests of distant vision should be made with the patient's distance glasses, if he has them, and tests for near vision with his reading glasses. If the vision for distance is below normal and he has no distance glasses one is sometimes compelled

to rely on his statements as to whether there has or has not been recent failure of distant vision.

In the early forties, one's near vision fails from presbyopia, so a history of failing vision in middle age or later is of no neurological significance unless the patient is sure that it is his distant vision that has failed. A careful determination of the refraction is often desirable. In testing the illiterate or the aphasic, the Fridenberg test card on which groups of squares graduated in size replace the usual letters is especially useful, since the illiterate will count the squares in the group indicated and the aphasic will hold up an equal number of fingers.

Tests of the field of vision: When vision is very poor, tests may have to be made with the pocket flash light or with the moving hand, but with fair vision for routine purposes a white pinhead of about 3*mm* is the most useful test object. With the normal eye the field for this 3*mm* test object has almost the same extent as that of the usual 1*cm* perimetric test object, but defects in the field of an abnormal eye are much more readily discovered with the smaller object. When this test object is held half way between the eye of the observer and that of the patient, 50*cm* apart, the field of each eye should be equal in extent and if in any meridian the patient loses sight of the test object before the observer, his field is restricted in that meridian. In testing for relative hemianopsia and for central scotomata, a small red test object is useful, or the same 3*mm* pinhead may be used by the observer while standing several feet from the patient who fixes the observer's eye. The greater the distance the more delicate the test.

Bjerrum devised a black cloth screen 2*m* in diameter to be viewed at a distance of 2*m*, and used test objects of white ranging from 1 to 10*mm* in diameter, mounted on black rods which are nearly invisible against the background. His method is useful for plotting small or relative defects such as central scotoma, enlargement of the blind spot, or the like. Small hand compimeters are rather more useful than perimeters in plotting defects near the point of fixation.

Considerable practice is required to plot a visual field accurately with the perimeter because the patient becomes

fatigued and unreliable in his answers, or may not maintain proper fixation. What we wish to know for diagnosis is not so much the actual amount of contraction as the type of contraction, and this can be determined by the simpler tests.

Contraction of the field of vision, in nervous diseases, is found chiefly in four types, namely, concentric contraction, central scotoma with normal limits of the field, bitemporal hemianopsia or loss of the temporal half of the field for each eye, and homonymous hemianopsia or loss of the right or of the left half of the field for each eye.

Concentric contraction is the rule in simple atrophy of the optic nerve such as that occurring in tabes. This same sort of field is found in beginning post-neuritic atrophy, such as that following the papilledema of brain tumor. The atrophy following papilledema is caused by the compression of the nerve fibers, and the arteries as well, by exudated material, and in its final stages we find the nasal half of the field defective, just as the nasal half of the field fails in the compression atrophy of the nerve occurring in glaucoma from high intraocular tension. A concentric contraction of the field becoming smaller as the test is continued is known as the fatigue field and is a functional disturbance often associated with hypesthesia of the cornea.

Central scotoma is chiefly due to affections of the papillomacular bundle—the group of visual neurones beginning in the ganglion cells of the macular region of the retina, passing to the temporal sector of the optic-nerve head and then extending back through the optic nerve as its central or axial bundle of fibers. This bundle is particularly susceptible to compression and to poisons. Central scotoma in one eye due to pressure is found with frontal-lobe tumors of the same side, and also with retained secretion in the posterior ethmoid cells in acute sinusitis. Central scotoma of both eyes of toxic nature is seen in chronic tobacco poisoning, in acute wood-alcohol poisoning, and in diabetes. A large central scotoma, or a number of minute scotomata near the center, is the commonest visual-field defect in disseminated sclerosis, although concentric contraction is often found with or without the central scotoma. Furthermore, hemorrhage in the macular

ILLUSTRATING DOCTOR HOLDEN'S ARTICLE, "AN INTRODUCTION TO NEUROLOGICAL OPHTHALMOLOGY."

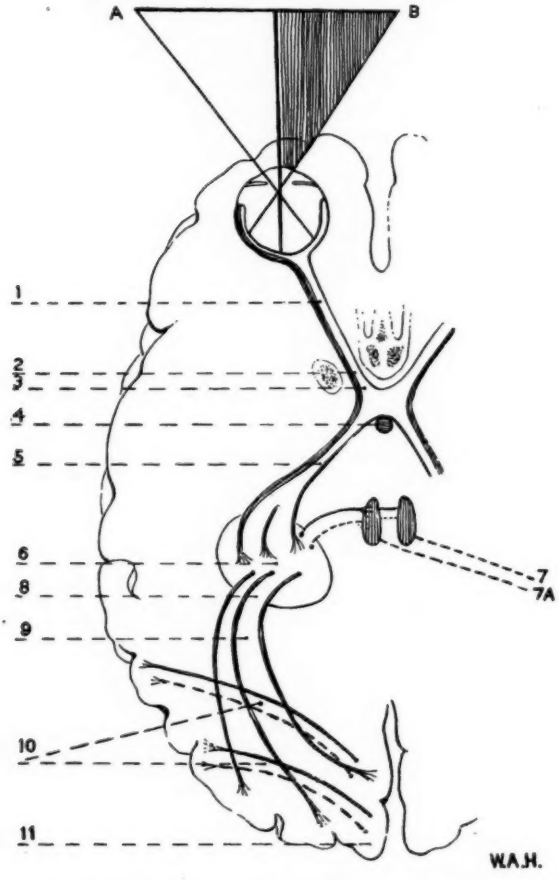

FIG. 1.—A DIAGRAM OF THE LEFT VISUAL PATHWAY.

The dark outer portion of the optic tract and nerve represents the uncrossed fibers, which run from the temporal half of the retina and correspond to the shaded nasal half of the field B.
The light, inner portion of the tract and nerve represents the fibers which, crossing in the chiasm, run from the nasal half of the retina and correspond to the unshaded temporal half of the visual field A.

1. *Optic nerve in the orbit.*
Pressure from hemorrhage, œdema, or tumor causes various degrees of amblyopia and various contractions of the field, with papillœdema later, or with simple atrophy of the disk.

2. *Optic nerve in the optic foramen.*
Pressure here from diffuse periostitis following ethmoiditis causes first a central scotoma and later complete blindness, with papillœdema some time after the onset. Pressure here from localized luetic periostitis causes first a peripheral defect in some portion of the field. Pressure here after fracture of the bone through the optic foramen causes very poor central vision and usually a lateral or vertical hemianopic defect in the field, with pallor of the disk.

3. *The optic nerve just anterior to the chiasm.*
Pressure here from tumor of the frontal lobe causes first central scotoma and later blindness with pallor of the disk.

4. *The infundibulum of the pituitary body.*
Dilatation of the infundibulum or enlargement of the pituitary body will compress the crossing fibers in the chiasm and cause defects in the temporal half of the field of each eye, with pallor of each disk, accompanied usually by a slight œdema of each disk.

5. *Left optic tract.*
Pressure here causes right homonymous hemianopsia with pallor of both optic disks.

6. *The external geniculate body, the anterior quadrigeminal body, and the optic thalamus,* in which terminate the first visual neurones coming from the retina. Association fibers run hence to the nuclei of the 3rd nerves, 7 and 7A. Disturbance of these association fibers causes reflex iridoplegia (Argyll-Robertson pupil).

8. The beginning of the second visual neurones, which make up the *Optic Radiation of Gratiolet.* A lesion here causes right homonymous hemianopsia with possible involvement of the nerves supplying the ocular muscles and also the auditory nerve. A lesion just posteriorly in the internal-capsule region may cause hemiplegia or hemianæsthesia as well as hemianopsia, without pallor of the optic disks (*Carrefour sensitif* of Charcot).

9. Pressure upon *the optic radiation* here may cause right homonymous hemianopsia without other symptoms.

10. *The association tracts running from the calcarine fissure to the angular gyrus.* A lesion here will cause hemianopsia and, if on the left side, alexia or agraphia as well. Destruction of the angular gyri and neighboring structures in both hemispheres, even with intact optic radiations, will cause complete mind blindness.

11. *The pole of the occipital lobe,* the center for central vision. Destruction of the pole of each occipital lobe will cause a central scotoma in the field of each eye.

region of the retina in cases of arterial sclerosis, causing central scotoma, is quite common.

Bitemporal hemianopsia is caused by pressure upon the crossing fibers in the optic chiasm and is usually due to an enlarged pituitary body or a dilated infundibulum compressing the chiasma from behind, below or above. In the beginning, there is a relative loss of the temporal half of each field—that is, large test objects are recognized, but small white or colored test objects are not seen. Later, not even a light can be recognized in the temporal fields and the upper or lower nasal quadrants also become involved. Finally, the fields may be lost entirely and complete blindness in both eyes result. A radiograph of the sella turcica will usually show enlargement or distortion of the sella.

Homonymous hemianopsia can be caused by disturbance of the visual fibers at any point between the chiasm and the cortex of the cuneus. (See Fig. 1.) The lesion occurs frequently in the internal capsule or in the cortex about the calcarine fissure, but is quite rare in the optic tract. In cases of tract lesion, the optic discs become pale and accompanying basilar signs usually render the diagnosis possible. In lesions behind the optic thalamus, the optic discs remain normal. The so-called hemianopic loss of pupillary reaction when light is thrown upon the blind half of the retina, as a diagnostic sign of tract hemianopsia, is of no value whatsoever and should no longer be described in the text-books.

When the lesion causing the hemianopsia involves the corpora quadrigemina, paralyses of ocular muscles and deafness are likely to be present. A lesion in the optic radiation, if near the thalamus and internal capsule, frequently is accompanied by hemiplegia of the same side and less frequently by hemianesthesia. Lesions further back, subcortical or cortical, may cause hemianopsia without other symptoms if the association tracts are not involved. These association tracts run from the visual perceptive center in the calcarine region on the mesial surface of the occipital lobe to the visuo-psychic sphere which extends on the convexity of the lobe as far forward as the angular gyri. Destruction of these higher centers on both sides will lead to mind blindness. Destruction of the visual fibers of the optic radiation, together with certain

association tracts on the left side, will cause hemianopsia with alexia or agraphia.

It has been wrongly assumed by some that a so-called hemiachromatopsia indicates an involvement of a special color center. Hemianopsia, however, may range in degree from a slight relative to an absolute defect, and when the field is complete for large white objects but defective for one or more colors, it will be found that the field is equally defective for such small white objects as have a field equal to that for each color in the normal eye, as was pointed out by the writer many years ago.

Gunshot injuries of the occipital lobe producing hemianopsia have been very frequent in recent wars and the records of army surgeons have contributed not only to our knowledge of the clinical varieties of the hemianopic conditions but also in greater degree to our knowledge of retinal representation in the cortical visual area—the area striata. A paper on "Disturbances of Vision from Cerebral Lesions," in *Brain*, 1916, p. 37, by Gordon Holmes and W. G. Lister, summarizing their records made in base hospitals in France, is a contribution of very great value. They group their cases of visual-field defects into four categories:

I. Quadrantic symmetrical defects in the two fields, (*a*) one quadrant wanting, (*b*) two quadrants wanting, and (*c*) three quadrants wanting. The inferior quadrants were wanting much oftener than the superior, because a superior defect means a lesion in the inferior portion of the area striata, which is likely to involve the cerebellum and be fatal.

II. Central scotoma in the field for each eye, usually symmetrical, due to injury of the tip of each occipital lobe.

III. Homonymous hemianopsia with central scotoma (the central scotoma representing a central or paracentral hemianopic defect on the side opposite to the complete hemianopsia) due to an oblique injury through the optic radiation on one side and the posterior tip of the occipital lobe on the other. (See Fig. 2.)

IV. Paracentral symmetrical homonymous scotomata, sparing central vision and being more extensive the further forward the injury.

These authors conclude, in brief, that each macula lutea

ILLUSTRATING DOCTOR HOLDEN'S ARTICLE, "AN INTRODUCTION TO NEUROLOGICAL OPHTHALMOLOGY."

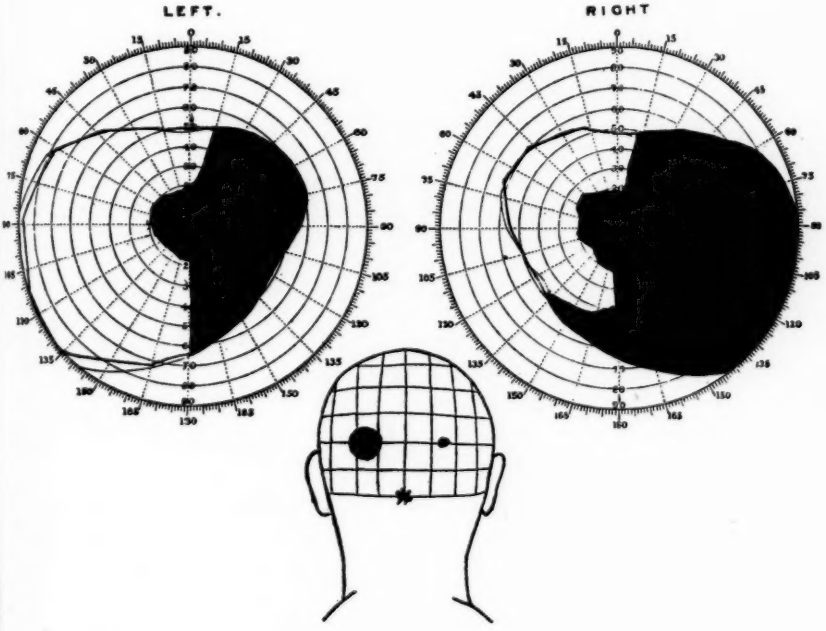

FIG. 2.—After Gordon Holmes and W. T. Lister. Rifle-shot wound of both occipital lobes; entry on the left, exit on the right; producing almost complete right homonymous hemianopsia, and also symmetrical central defects in the left halves of the field extending 20° from the fixation point in each meridian.

has a representation in one occipital lobe only, not in both, as had generally been believed; that the center for the macula lies in the posterior extremity of the area striata, probably on the margins and the lateral surface of the occipital poles; that the upper portion of the retina (and the lower portion of the field of vision) has its representation in the cortex above the calcarine fissure and the lower portion of the retina in the cortex below the calcarine fissure; and that the representation of the portion of the retina near the macula lies near the pole of the occipital lobe, while that of the periphery of the retina lies anteriorly.

It has long been recognized that when a right homonymous hemianopsia, for example, was later followed by a left homonymous hemianopsia, due to a second plugging of an artery, a small central field was sometimes preserved. These authors explain such cases by calling attention to the fact that the tip of the occipital lobe is often supplied by the posterior cerebral artery, while the rest of the area striata is supplied by the middle cerebral artery. Thus, plugging of the branches of each middle cerebral artery would produce bilateral homonymous hemianopsia, but might spare central vision in each eye, since the cortical centres for central vision might be supplied by the posterior cerebral arteries.

OPTIC DISC.

The ophthalmoscopic changes in the optic-nerve head that interest us are atrophies and edemas. The *simple atrophy* or primary degeneration of the optic nerve is in the great majority of cases a symptom, early or late, of tabes. The retinal neuron first loses its medullary sheath, and later the axis cylinder and ganglion cell are absorbed. The spaces left are partly filled by proliferated neuroglia and the small blood-vessels disappear. In consequence the entire nerve head loses its pinkish hue and grows gradually paler until finally it becomes glistening white and sharply outlined, while the retinal arteries, whose function is to nourish the ganglion-cell and nerve-fiber layers of the retina, become narrow and sclerotic.

The patient notices first a failure of acuteness of vision,

and tests of the field show peripheric contraction. Central and peripheral vision fail gradually together and after the lapse of months or years complete blindness ensues, usually in both eyes.

Pressure upon one optic tract causes a slight general pallor of each disc, as does pressure upon the chiasm by an enlarged pituitary body. In the latter case we encounter a very slight edema of the disc as well. In optic-nerve affections due to ethmoid disease and to wood-alcohol poisoning, there may be at first considerable edema of the nerve head which soon pases off and is followed by the ophthalmoscopic picture of simple atrophy of the optic disc.

When the ***papillo-macular bundle*** alone is involved, causing a central scotoma without peripheric contraction of the visual field, the inferotemporal third of the optic disc becomes pale while the remainder of the disc retains its pinkish hue. This is the condition found in nicotine poisoning, diabetes, and in most of the optic-nerve involvements of disseminated sclerosis.

Papilledema, as it occurs in cases of brain tumor, is now generally regarded as being of a purely mechanical character, coming on in both eyes about the same time and running a fairly similar course in the two. A papilledema almost similar in character, but usually with less elevation of the disc and with more extensive involvement of the retina, occurs with meningitis. This variety is of a more inflammatory nature and the eye on the affected side of the head is involved before the other. The starting point of papilledema in brain tumor is a blocking of the passage from the third ventricle to the fourth. Blocking of this passage leads to an over-accumulation of liquid in the third and lateral ventricles, and this excess of liquid compresses the soft brain matter and forces the liquid in the subdural space out into the subdural lymph space of the optic-nerve sheaths which are continuous with the other.

The early or late appearance of papilledema depends much upon the situation of the tumor. A tumor of the third ventricle may block the passage to the fourth ventricle early and permanently, and cerebral decompression will not give relief. A tumor a little distance from the third ventricle, in the

ILLUSTRATING DOCTOR HOLDEN'S ARTICLE, "AN INTRODUCTION TO NEUROLOGICAL OPHTHALMOLOGY."

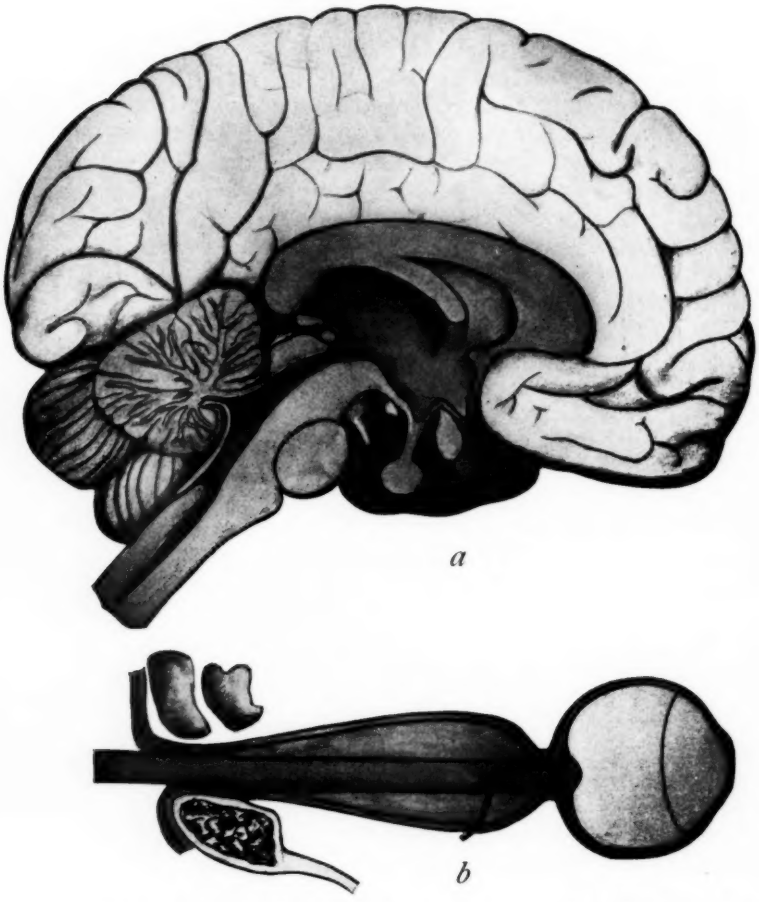

FIG. 3—(*a*) A diagram showing the third and fourth ventricles and the aqueduct of Sylvius. (*b*) Distention of the intervaginal space of the optic nerve with cerebrospinal fluid in papilœdema.

cerebellum, for example, will block the passage by compression fairly early. In such cases cerebellar decompression gives relief. Tumors distant from the third ventricle, in the frontal lobes or in the pons, for example, do not block the passage until late in their course and decompression may not be indicated. (See Fig. 3.)

The liquid in the subdural space of the brain, when forced under pressure into the subdural space of the optic-nerve sheath, distends this space, compresses the central artery and vein of the retina which pass through it, and to some extent strangulates the nerve head. The nerve head then becomes edematous together with the retina about it. The retinal arteries are narrowed and the veins are dilated and tortuous, from compression. After some months the nerve fibers are compressed and atrophy of the optic nerve ensues.

With the ophthalmoscope we find in the beginning a slight edema of the nerve head which veils its nasal margin. Then the upper and lower margins of the nerve head become veiled, the veins are dilated and tortuous, the nerve head and surrounding retina become swollen with edema, and often hemorrhages appear in the retina. Some weeks after the onset the swelling of the retina subsides to some extent and the nerve head as a rounded, grayish, pulpy-looking mass projects one or two millimeters above its normal level. This fourth stage of papilledema may continue for months. Later, a general pallor of the nerve head appears through the edema, as atrophy of the nerve sets in. The swelling of the nerve head from this time subsides gradually. As papilledema does not develop in a nerve which is already atrophic, so the papilledema subsides when the nerve becomes atrophied. For months or years longer the pale nerve head has blurred margins and the retinal veins remain dilated and tortuous.

Visual disturbances are noticed early. The patient complains of a cloud over his sight which annoys him. When his central vision is tested with a well illuminated test card it will be found to be normal or nearly so, but examination of the visual fields will show them to be defective. There may be or may not be concentric contraction of the field for white, but concentric contraction of the fields for colors is the rule. In a few cases pressure upon the chiasm, the optic

tracts, or the optic radiations will add symmetrical hemianopic defects to the existing concentric contraction of the fields.

After a time central vision deteriorates. Fluctuations of vision then occur. On days when the intracranial pressure is particularly high the headache will be more severe and the sight will be more blurred. Vision in one or usually both eyes may be lost completely for a few seconds or minutes at a time and such attacks may occur at very frequent intervals. When this stage is reached decompression cannot be longer postponed. The reduction of pressure by the operation dispels the cloud before the sight and leads to enlargement of the contracted visual fields. If, however, the vision has been reduced through atrophy of the optic nerve, further atrophy may be checked by the operation, but the lost vision will not be regained.

The cerebral decompression operation for the relief of failing vision is commonly regarded as being a procedure of very recent introduction, but, as we are learning more and more that our new ideas were already known to the ancients, it does not surprise us to find in the Hippocratic Writings (Hippocrates lived 2400 years ago) a passage on decompression which runs roughly as follows: "If vision fails without demonstrable disease of the eyes, incise the scalp, separate the soft parts, and remove a portion of the bone of the skull, thus releasing the accumulated liquid that by its pressure has caused the deterioration of vision."

Intracranial hemorrhage may cause increased pressure with a certain degree of papilledema when the blood pressure rises as shock passes off. This papilledema is a symptom of value in confirming the existence of increased intracranial pressure, but in itself does not cause disturbances of vision or require cerebral decompression for its relief.

OTHER ANOMALIES

Retraction of one or both upper lids is a manifestation of excitation of the cervical sympathetic nerve, which causes a contraction of the small unstriped muscle in the upper lid supplied by the sympathetic. This is sometimes an early sign of exophthalmic goiter. It is this retraction of the

upper lid that gives rise to the Graefe symptom in exophthalmic goiter—the lagging behind of the upper lid when the eyes are slowly turned downward.

Pulsating exophthalmus is usually due to a fracture in the middle fossa of the cranium which tears the internal carotid and permits communication between the carotid artery and the cavernous sinus. Arterial blood is forced back into the veins of the orbit and causes protrusion of the eyeball. The diagnosis of this arterio-venous aneurysm is verified by the bruit heard with the stethoscope when placed on the temple or by the subjective pulsation and bruit experienced by the patient.

The psycho-genetic disturbances of the eye: In neurasthenia, psychesthenia, hysteria, the traumatic neuroses, the different varieties of shell-shock, and in simulation, ocular disturbances are found, which may be classified as anesthesias, spasms of the voluntary muscles, and disturbances of vision. The anesthesias or hypesthesias occur in one eye or in both and are revealed by touching the cornea with a piece of cotton, when the normal reaction is found to be absent or diminished.

The spasms comprise (1) a tonic or clonic contraction of the sphincter oculi, causing a closure of the lids, or when of lesser degree a drooping of the upper lid (ptosis), which is often found to be spasmodic and not paralytic, since the patient resists attempts to raise the lid by force; and (2) a spasm of the internal recti, by which the patient produces a convergence of the eyes and sees double. If he says that he sees with one eye a light single at one distance and double at another distance, the disturbance is unquestionably functional.

The visual disturbances are subjective or objective. In the former the patient sees flashes of light or spots and clouds before his vision, or objects appear larger or smaller than they should, due to spasm of accommodation, or images usually suppressed are recognized, so that, for example, the patient may complain of seeing his nose, or after-images may be of long duration, or a host of other purely subjective disturbances may be complained of.

Besides these there are disturbances of vision capable of demonstration. First, there is concentric contraction of the field for small white and colored test-objects with normal

acuteness of central vision. In easily fatigued persons this contraction is progressive as the test proceeds and forms a diminishing spiral. Second, with some concentric contraction there is reduction of central vision and the letters on the test card are not read so far down as the patient's refractive condition should allow, but by forceful urging many of these patients can be induced to read the test letters as far down as they should. Third, there may be a fixed diminution of central vision or a fixed defect of almost any character in the field of one or both eyes. These defects are likely to be suggested by the first examiner and to be fixed in the patient's mind at that time. Fourth, there may be blindness more or less complete in one eye, which can be unmasked by some of the tests used by the oculist to detect simulated blindness. Fifth, there may be apparently complete blindness in both eyes. This condition is usually an asset to the patient and a measure of defense against something he wishes to avoid seeing or against some task from which blindness relieves him. In all these cases the optic discs are normal in appearance and the pupils are active or but slightly sluggish.

The functional nature of the condition is betrayed, as a rule, by the lack of co-operation of the patient in moving his eyes. If directed to turn the eyes to the right, for example, he apparently makes a great effort to turn the eyes in that direction, but in reality makes an effort not to turn the eyes to the right. The presence of hypesthesia of the cornea and other functional disturbances supports the diagnosis, and his recent psychic experiences, which can be learned from his associates, together with his obvious desires, confirm the diagnosis.

A CASE OF LEUCOSARCOMA OF THE IRIS, TREATED BY RADIUM.

By Dr. SANFORD GIFFORD, Omaha, Nebraska,
1st Lieutenant, M. R. C.

(With two illustrations on Text-Plate XIV.)

SARCOMA of the iris is not so rare that the report of such a case alone would be particularly valuable, but the opportunity for pathological examination after systematic treatment by radium is so unusual as to be worth recording.

Case.—The patient was a man of fifty-two years, who was referred to Dr. Harold Gifford on February 10, 1915. He reported that for two or three years he had noticed a small spot on the lower part of his right iris, which had been gradually increasing in size. No subjective symptoms. Present condition: L. E. normal vision, $\frac{20}{15}$; R. E. showed a pinkish, somewhat lobulated tumor about $\frac{3}{16}$ of an inch in diameter, taking in the greater part of the lower and inner quadrant of the iris, projecting forward so as to touch the cornea, leaving but one millimeter of the iris root apparently free. In other respects normal. Vision $\frac{20}{15}$. (See Fig. 1.)

The difficulties and dangers of the situation were explained to the patient and he decided to try treatment with radium, rather than to have the eye enucleated or the tumor removed. From February 11th to the 20th, he received a treatment daily with from 32 to 48 milligrams of radium bromide, each treatment lasting from twenty to thirty-five minutes, the tube being applied to the outer surface of the closed lids in all of the treatments except two. At these two treatments, the tube was held directly across the cornea by conjunctival sutures. The immediate result of this treatment was that about February 25th, after he had returned home, he developed a right-sided facial paralysis which Dr. Quigley has informed me he has noticed in other

cases where radium has been used freely. This paralysis persisted for nearly a year and then gradually disappeared. The tumor diminished somewhat in size after the lapse of a month, but by the middle of May it again showed slight signs of increasing, and Dr. Quigley applied the radium in the same amount as before for nearly two hours with the tube directly in contact with the cornea.

He was not seen again until September 11, 1917, when he returned stating that the eye had given him quite a little trouble with pain and irritation for several months, and as his home physician had advised him to have the eye enucleated, he came down to have it done. The tumor was found to be decidedly smaller than when he was first seen, the portions in the chamber proper having largely disappeared. But it had become adherent to the cornea which showed a vascular pinkish area about an eighth of an inch in diameter, extending through the entire thickness and slightly raising the surface. From the posterior surface of the cornea, the tumor ran down and back to a small attachment at the extreme periphery of the iris. The eye was moderately congested and irritable, and the fundus could not well be seen on account of the opacities in the lens capsule and in the vitreous. The vision was $\frac{20}{100}$, not improved by glasses, and the tension raised to forty-five millimeters as opposed to twenty-three in the other eye. In other words, the condition of the tumor itself was relatively favorable, but the eye seemed to have suffered so much from the effects of the radium and the patient was so determined to get rid of it that it was enucleated. Unfortunately, no photograph of the patient was taken before enucleation, which would have showed the marked change from the condition seen in Fig. 1.

PATHOLOGICAL REPORT.

Iris: At the pupillary margin, the iris is thickened, forming a club-shaped prominence forwards. This is raised about 30 microns from the anterior surface of the iris. It is composed of large spindle cells with dark staining oval nuclei, arranged in whorls around dark staining round oval bodies of various sizes which seemed to be the nuclei of the spindle cells in cross-section, though some may be round cells. No mitoses are found. The spindle cells merge into the stroma, getting smaller, and in the stroma no round cells or sections of large nuclei are found. It appears normal except for one place at the root, where it is adherent to the cornea, and for one area of lymphoid infiltration. No pigment is found in the tumor part, and the arrangement of

ILLUSTRATING DR. GIFFORD'S ARTICLE ON "A CASE OF LEUCOSARCOMA OF THE IRIS, TREATED BY RADIUM."

FIG. 1.

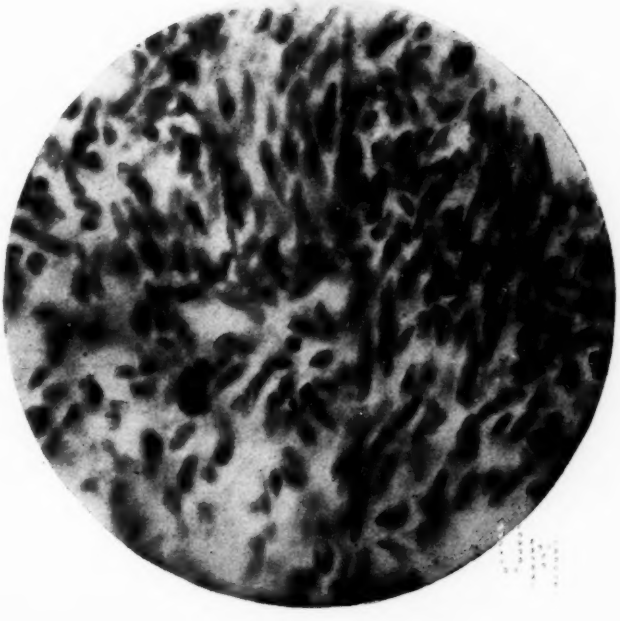

FIG. 2.

pigment in the rest of the iris is normal At the root where it is adherent to the cornea, there is slight infiltration with polymorphs and leucocytes in its anterior layers. The above changes are found only in the sections of about 2 millimeters of the lower central iris. (See Fig. 2.)

Cornea: The endothelium at one place near the iris angle is adherent to the iris, and is wrinkled and defective. The corneal layers over this are infiltrated with polymorphs, lymphocytes, and connective tissue cells running in irregular directions. Under the epithelium are three large vessels in section surrounded by polymorphs and round cells.

Ciliary Body: In the above sections, there are a few round cells at the base of the ciliary processes. In sections taken near this, but not showing the tumor, is seen a collection of cells with dark staining round nuclei. The round cells spread out into the ciliary processes and back into the muscle. A few pigment cells are seen among them. (In the iris, about halfway to the pupillary border, next the pigment epithelium, is a small group of these round cells.) These cells are smaller than the cells of the tumor, regular in size and shape, and appear like lymphocytes.

ANATOMICAL DIAGNOSIS: Spindle-celled sarcoma of the iris with secondary reparatory changes.

Subacute and chronic inflammation of cornea at one point with adhesions to iris.

Lymphoid infiltration of ciliary body and root of iris.

Levin and Joseph (1) have recently described conditions found after treatment by radium of cancers of the breast and other regions, which they call sterilization of the neoplastic cells. By this they mean that the cells are still present, unchanged or in various stages of regression, and often surrounded by connective tissue, while the tumor has not increased in size, nor the cells spread to other regions.

Morson (2), Wassermann (3), and Prime (4) reached the same conclusion, the last two after treating mouse cancer cells in vitro by radium and finding that, while remaining alive, they cease to show mitoses and fail to produce cancer when injected into healthy mice.

Levin and Joseph suggest that this loss of reproductive power is the first stage in a cure of cancer which is followed by the ageing and death of the cells. They believe this is the condition in cases of clinically cured cancer when the tumor remains, but does not increase in size or form mitoses, for a

sufficient length of time to preclude the chance of a spontaneous recurrence.

The case here reported seems to present much the condition which they describe, the cells showing no mitoses or evidence of spreading into neighboring tissues. About two hundred sections were cut out and specimens examined at frequent intervals from the whole circumference of the globe, so it is certain that there were no other foci. The primary growth has been reduced in size.

DISCUSSION: The spindle cells seem to be the characteristic cells of the tumor. The round cells in the ciliary body and the small collection in the iris are different from the cells of the growth, and would seem to represent a lymphocytic reaction such as usually follows treatment by radium.

The adhesion to the cornea and the reaction around it are probably the result of direct contact of the tube of radium with the cornea. There is no evidence of extension of the tumor at this point nor is the pink area in the cornea part of the tumor, as implied in the clinical record.

The loss of vision may be due to vitreous opacities formed in reaction to the radium or to organization of exudate formed when the tumor was growing.

THERAPEUTIC DEDUCTIONS: The two accepted treatments for sarcoma of the iris are iridectomy and enucleation. Wintersteiner (5) well sums up the opinion on these two measures. The commonest opinion is in favor of primary enucleation except under certain well defined favorable conditions.

For Wintersteiner these are met only when:

1. Vision in the eye is good.
2. The iridectomy offers no obstacle to complete removal.
3. The tumor is small, slow-growing, well defined, and at the pupillary edge. It must not reach into the anterior chamber, touch the lens or cornea. There must be no other pigment flecks or diffuse staining of the iris. Tension must not be increased. Under these conditions he would do iridectomy followed up by observation and enucleation at first sign of recurrence.

On the other hand, he says, Kerschbaümer, Wood, Pusey, Coffey, Vaucleroy, and Schleich always advise primary enucleation.

Wintersteiner points out that there is some danger of iridectomy's producing metastasis but this is also true of enucleation, and cites six cases of metastasis after primary enucleation.

I can find no other record of the use of radium in new growths of the iris. It has been used with some success, however, in other intraocular tumors.

Deutschmann (6) reports treating by mesothorium a melanosarcoma of the choroid in the left eye of a man of 51 whose right eye had previously been enucleated after an accident. .01*gm* of mesothorium in a capsule was sewed into a conjunctival pocket and left for one to two hours. Nine days after this the tumor could be seen to be flattened. This was repeated three times at one-month intervals and then four times at two-week intervals. The subretinal effusion was withdrawn three times by puncture. At the end of this five-months period the marked projection first seen in the fundus was replaced by a series of folds and vision was fingers at three inches, when the case was lost sight of.

C. F. Clarke (7) treated sarcoma of the orbit by inserting a tube of radium in the orbit after canthotomy and division of the external rectus. It was left in four hours and this was repeated every two weeks. The proptosis quickly receded and in two years the case was apparently cured. It is interesting to note that a nuclear cataract developed after six months of the treatment, perhaps due to the radium.

Others have reported good results in treatment of recurrences in the orbit after enucleation for sarcoma (Sattler) and neuro-epithelioma (Theobald).

The most careful work was done by Axenfeld. He reported in 1915 (8) results eighteen months after treatment by radium and mesothorium of a case of glioma in a child whose right eye had been removed for glioma. At operation three foci of growth, one rather large, were seen in the left eye, and radiotherapy was begun. He made eleven careful fundus examinations, noting the decrease of the growth, and eighteen months after the first treatment reported that one area had disappeared, another was almost gone, and the third, the largest one, had very much decreased in size. In 1916 (9) he reports further progress: "The largest growths had completely dis-

appeared, leaving only an evidently dead preretinal trace," with no recurrence elsewhere.

He quotes Hillgärtner, who used the X-ray in bilateral glioma, and after 84 treatments reduced a tumor that filled the vitreous to ⅔ its former size. In the other eye the beginning of a glioma, which at first could be plainly seen, was completely resorbed. He says that Würdemann by X-rays stopped a glioma which had invaded the orbit and sinuses, and which had recurred repeatedly after simple exenteration. Also that Pusey was successful with X-rays in preventing recurrences of glioma and sarcoma after enucleation.

Axenfeld takes up carefully the question of harm to the function of the eye done by radiotherapy, which would, of course, occur to anyone who thought of using such treatment.

The experiments of Birsch-Hirschfeld showed a distinctly harmful effect on the eye, especially the retina of animals exposed to X-rays. Rauch's results were similar. Axenfeld points out, however, that they used unfiltered rays in their experiments, and that his own experiments, carried out with filtered rays, showed no demonstrable damage to the eyes. He used aluminum filters for his radium 3–4*mm* thick which excluded all but the hard, deeply penetrating gamma rays. For mesothorium, which he used twice, he used a lead filter. His course was given in four groups of treatments of 6, 6, 3, and 2 treatments each in which doses of 10 to 35 of radium were given for 8 to 32 minutes at two- to ten-day intervals in each group and a month between the groups (two months before the last group).

As to the damage done to his case, nothing could be certain till it became old enough for subjective tests.

In the case here reported, some of the changes in the globe were almost surely the result of the rather intensive radiation. Such were the vitreous opacities and a slight diffuse cloudiness of the cornea. No changes were observed in the retina which was examined, though loss of part of the specimen in cutting prevented a very careful examination of the whole retina. The opacities, however, were probably sufficient to account for his loss of vision from $\frac{20}{15}$ to $\frac{20}{100}$. The filter used was silver.

In considering the possibility of treating by radium or X-

ray it is apparent that the iris offers very favorable conditions for such treatment. The rays reach the growth through the clear cornea almost as if it were on a skin surface, and the results of the treatment are as open to observation. If it is unsuccessful and the growth continues to increase, operation may be resorted to with about as good a chance of success as if it had been done at first. It may be with even a better chance, as even partial sterilization of the tumor cells would lessen the danger of their multiplying if some of them should be forced into the circulation by the operation.

Though the results from such treatment in intraocular tumors have been so far rather meager, some of them seem very positive. It would seem, then, especially in tumors of the iris, that treatment by radium should be seriously considered. Where the growth is not especially rapid, even if it has reached the iris root, such treatment should be offered to the patient as an alternative to operation, he being observed carefully during each treatment. Where operation is refused, it would seem only just to the patient to advise radium very urgently.

I take occasion here to extend my hearty thanks to Dr. D. T. Quigley, for accurate records of treatments, to Dr. Chester E. Waters for examining the sections, and, most of all, to Dr. Harold Gifford for permission to use the material and assistance in reporting on it.

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SOME COMMENTS UPON THE PROBABLE CAUSE OF EXOPHTHALMIC GOITER.

By Dr. JOHN DUNN, Richmond, Virginia.

IN the *Archiv für Augenheilkunde*, lxxvii. Band, Heft 1, 1914, Prof. Dr. Schoenborn, in an article on the "Pathology and Treatment of the Diseases of Internal Secretion," says of Basedow's disease that the primary cause of its production is in the great majority of cases obscure. It has been attributed to "both psychic and somatic insults"; further to infectious diseases (sore throat, typhus, scarlet fever, syphilis, and tuberculosis), to primary infection, to tumor of the gland itself, and finally to drug poisoning (iodine), and to overuse of the extracts of the gland itself and, perhaps, to intestinal intoxication. Prof. Schoenborn continues: "The uncertainty which surrounds its genesis and etiology makes itself felt in the treatment." Then follow comments upon the better known therapeutic and surgical suggestions, the interesting feature about which suggestions is that *not one of them takes into consideration the possibility of a therapy which is based upon the removal of an active cause*, and thus obtaining a cure. For the views which are expressed in this article no originality is claimed by the author. They are an outcome of the practical application of the results of the work done by others in tonsillar pathology; in especial the studies in focal infection by Rosenow and Billings. The excuse for reporting the following cases is to be found in the fact that Basedow's disease has problems which may not be excluded from the domain of ophthalmology. The various phases of the ocular picture in ophthalmic goiter are well known to all oculists, and any suggestions which offer a probable definite, constant, contributing, if not also originating, cause of hyperthyroidism

are worthy of consideration by them. The cases selected in this paper for illustration seem to prove that in acute thyroiditis (Case 1), and in hyperthyroidism (Cases 2, 3, and 4) ***the main agent at work in causing the continuance of the thyroid changes is an infectious one.*** From this standpoint our problem in any given case resolves itself into discovering the source of this infection and a discussion of the possibility of its removal. The question as to what it is in the first place determines that the infectious agent in the blood should select the thyroid substance rather than a joint or the endocardium for its focal action, probably finds its answer in the following: Trauma, inherited lack of resistance, and functional exhaustion. Granted that the conditions in the thyroid have been rendered favorable for the reception of certain infectious agents in the blood and that the gland becomes inflamed, then there develops within the thyroid a selective affinity for those same varieties of microörganisms whenever thereafter they are in the blood in excess of the blood's ability to dispose of them. This same thing applies to other parts of the body and explains the recurrence in iritis, focal choroiditis, endocarditis, articular rheumatism, etc. Our problem in treatment, other than surgical, of the thyroid then resolves itself into two parts. The one is to free the body from the presence of the foci which contain the special microörganism. The other is to strengthen the resisting powers of the body. That the latter, which has heretofore consisted chiefly in prolonged rest and selected feeding, has at times been followed by a marked lessening of the hyperthyroidism is well known. The aims of this form of treatment are, however, too indefinite to be used except as an adjunct or as a *dernier ressort.* That the importance of the search for a chronic focus of infection in the treatment of Basedow's disease is not generally recognized is shown by the fact that surgical effort, save in a few places, is almost exclusively directed towards the overacting thyroid, the cause of the symptoms of hyperthyroidism, rather than towards a chronic focus of infection as the cause of the thyroid changes.

CASE 1.—Mrs. I., aged 26, had an infection of the left lower lid which resulted on the third day in an abscess with considerable swelling of the adjacent structures. The patient's neck began to swell and when I saw her on the fourth day

there was a marked enlargement of the thyroid with equally marked symptoms of acute oversecretion on the part of the gland. "Doctor, isn't it strange that I should have both the lid trouble and the throat trouble at the same time?" the patient asked me. The lid abscess was opened and a solution of nitrate of silver was applied to the cavity. A mercurial was ordered and in less than a week the thyroid enlargement and the symptoms of hyperthyroidism had disappeared. At the time this case was under my care, I had not associated thyroid disturbances with tonsillar disease and the tonsils were not examined. The case, however, was in my experience so unusual that I made notes of it. Whether or not the thyroid inflammation was secondary to infection from the lid abscess or whether both were to be referred to a focus of infection selected elsewhere in the body, I cannot positively state. The prompt disappearance, however, of the thyroid disturbance following the treatment of the lid abscess made me at the time believe the former to be the case. If so, it is difficult to understand why more cases of a similar nature have not been reported by ophthalmologists.

CASE 2.—The second case is that of Mrs. L., aged 36, and belongs to the type of thyroid disturbance which may be termed subacute hyperthyroidism. The thyroid was much enlarged and soft. There was a moderate exophthalmos, remittent attacks of increased pulse rate, and an almost continuous mild degree of abnormal nervousness, the details of which Mrs. L. could not put into words. Both tonsils had chronically diseased crypts. The enucleation of the tonsils was followed, without other treatment, by so marked a reduction in the size of the thyroid as to render its hypertrophy demonstrable only by palpation and by the disappearance of all the symptoms due to hypersecretion on the part of the gland and by recession of the eyeballs. This case has several points of interest. Some years before Mrs. L. had been treated by me for an attack of acute hyperthyroidism. I had at the time not suspected the possibility of a chronic focus of infection. The acute symptoms subsequent to (rather than as the result of as I now think) a course of general (!) treatment subsided, leaving a somewhat enlarged thyroid with a subsequent history of dysthyroidism. The tendency of this case was more and more towards the development of continuous hyperthyroidism and I believe at the time the tonsils were removed that a full-fledged acute case of Basedow's disease with excessive exophthalmos was imminent. The prompt disappearance of all symptoms of thyroid disturbance can be attributed only to the removal of the tonsils, or rather, to

the removal of the chronic foci of infection which the tonsils contained. As I now see the original attack of acute thyroiditis, I believe it was secondary to tonsillar infection.

CASE 3.—A further example of this type of thyroid disturbance is the case of Mrs. L., aged 50. The occasion of her visit was the sensation as though her collar were too tight and this although her neck was bare in front. At times this sensation was so pronounced as to cause her to feel as though she were choking. Examination revealed a deep-seated enlarged thyroid. The central lobe seemed not to participate in the hypertrophy. There was the accompanying history of mild, though pronounced, hyperthyroidism. The point of interest for us here is that the enlargement in the neck "came on at the time *I had an abscess in my throat four years ago.*" Neither tonsil was healthy. In this connection two questions will probably be asked. What constitutes a chronically diseased tonsil? And why, so long as the tonsil remains in situ and diseased, should there be any subsidence of the symptoms? The former question has been rather fully gone into in an article entitled "The Tonsil as a Source of Infection in Iritis" (in ARCH. OF OPHTHALMOLOGY, vol. xlvi., No. 5, 1917). Without entering at length into the second question, it may be stated that the entrance into the blood of infectious agents from a diseased tonsillar crypt is not necessarily at all times constant. The abrasions of the mucous areas of the crypts caused by the presence of microorganisms, their products and cast-off epithelial cells may at times heal over and remain healed for a time, and this is rendered possible not only by the protective shutting off of the region of the abrasions such as takes place about all chronically ulcerated places, but further by the fact that from time to time the emptying out of the contents of the crypts does away for the time being with the element of pressure against the walls of the crypts. Fresh ulcerations recur with a sufficient accumulation of the above-mentioned substances. There is, besides, a further reason: the quantity of microörganisms entering the blood from these foci of infection even when constant may be less than that which can be destroyed by the blood cells and so none reach the region of selective affinity (in this case, the thyroid). Thus we can understand how anything which lessens the "resisting qualities of the blood" increases the probability of disturbance in any given area of "selective affinity."

CASE 4 is that of Mr. G., aged 28, and is one of Basedow's disease, of between three and four years' standing; at time of his visit in its acute stages. Both eyeballs showed a high degree of exophthalmos with marked Graefe's sign. A

large bulging thyroid extended entirely across the front of the neck. Patient was unable to sleep, unable to digest his food, unable to do any work, or to use his eyes for reading or writing. His general nervousness was pitiable to behold. Pulse rate was high. Both tonsils were diseased. Double tonsillectomy was done. Three months later there had taken place such a change in Mr. G.'s appearance that I failed to recognize him when he called at my office. The exophthalmos had entirely disappeared. The thyroid had so diminished in size as not to be noticeable on careful inspection. Mr. G. stated he now slept all night and could eat what he wanted to and work as much as he pleased. His nervousness had disappeared. He said, "I am well." There, however, remained an easily excitable pulse and on palpation the thyroid was still enlarged. Two months later the same condition of the pulse persisted and there was a slight, although demonstrable, further enlargement of the thyroid. Mr. G., however, was according to his own accounts "well." I do not, however, consider him so. The tendency for the thyroid to enlarge indicates that there persists somewhere in his body an additional focus of infection which is still at times pouring into the blood microörganisms in a quantity sufficient to reach the weakened thyroid. As yet I have been unable to decide where this focus is. This case is not reported as a case of cured Basedow's disease, but because it serves to accentuate the probability that hyperthyroidism is the result of infection and that at times the focus may be situated in the tonsillar crypts. The interesting feature of this case is the entire disappearance of the exophthalmos, a symptom which often persists for a long time after surgical operation upon the thyroid. Taken together these four cases seem to show that infection within the tonsil is one of the causes of enlargement of the thyroid. Since my attention was directed to this subject, I have examined the throat in all cases of Basedow's disease which have come to my office and in all, save two of them, there was demonstrable disease of the tonsils, and in no one of them had a connection between the diseased tonsil and the hyperthyroidism been suspected. There may have been disease of the tonsil in these two. One was seen before I appreciated the importance of chronic tonsillar disease in its relation to inflammatory troubles in distant organs. In this case I did not examine carefully the crypts of what was an apparently normal organ.

I have examined also the throats in a considerable number of cases of simple goiter occurring in girls and young women, and with few exceptions all of them had demonstrable disease

of the tonsils. The coëxistence of tonsillar disease and hypertrophy of thyroid does not necessarily prove that the latter is the result of the former, but taken in connection with the results obtained in such cases as the above,, and I have had a considerable number of similar results, we may safely state that chronic tonsillar disease (and the same would apply to any other chronic focus of infection anywhere in the body) may at least determine exacerbations and continuance of the thyroid disturbances. In regard to simple goiter, it is significant that the vast majority of them begin in youth when the tonsils are most subject to acute inflammation, and in young women at a time when the normal functioning of the thyroid can be most easily rendered unstable through its interrelationship in its activities with the ovaries.

The subject of simple goiter is foreign to the purpose of the paper and further comment is omitted.

In this connection it will be of interest to comment upon three cases seen lately of Basedow's disease which had been subjected to thyroidectomy. Mrs. M., aged 36, had one half of the thyroid removed. Four months later the exophthalmos which had been excessive at the time of the operation showed no recession. There was no diminution of the pulse rate or lessening of the other nervous symptoms. ***Both tonsils were enlarged and inflamed.*** Seven months later—that is eleven months after the operation—the thyroid hypertrophy had disappeared. The exophthalmos had greatly lessened, but much more in the left than in the right side. The patient was still extremely nervous and pulse rate high. Her sleeplessness had in a great measure disappeared. Her appetite had returned, and her ability to take exercise had returned. It is of interest to note that within these last seven months the active tonsillar inflammation had subsided. In this case it is probable that there will be a recurrence of the thyroid disturbance should there be further active tonsillar inflammation.

In the case of Mrs. G., aged 39, operated upon eleven years previously, there had never been any exophthalmos. The ocular symptoms consisted, according to the patient, of a tendency of the pupils to dilate abnormally. This has disappeared, as have the nervous symptoms from which Mrs. G. suffered. Both tonsils show hypertrophic changes and there

is a history of many attacks of sore throat. This case, which may be considered cured, was probably of a mild type and it is probable that almost all of the thyroid was removed.

The third case is that of Miss L., aged 24. A part of the thyroid was removed in 1912. In March, 1917, the symptoms being worse than they were prior to the first operation, a further resection of the thyroid was done. Six months later the nervous symptoms had disappeared. There was never marked exophthalmos. There is, however, still present the exophthalmic stare without any protrusion of the eyeballs. This apparent lack of normal mobility of the eyes told the story of Basedow's disease, before the neck was looked at or any questions asked. In this case, the appearance of the neck suggested that only a small portion of the thyroid was left after the second operation. ***Both tonsils tell the story of repeated infections.***

Conclusions. When for reasons either inherited, functional, or traumatic, the normal resistance of the thyroid has been so lowered that it becomes a "receptive focus" for any special species of microörganisms, there may in the future result thyroid disturbances of varying degrees of intensity whenever these same microörganisms are present in the blood in numbers greater than the blood's ability to digest them. A *chronic* focus of infection is the most common source of these microorganisms. While, in any given case, the focus may be situated anywhere in the body, ***the most common location in the case of both simple thyroid hypertrophy and hyperthyroidism is the tonsillar crypts.*** Where the focus can be entirely eradicated, the overactivity of the thyroid can be done away with. How far recession in the size of the thyroid is to be expected after the removal of the focus will depend upon the amount of fibrous changes already present in the gland. That the removal of a chronic focus of infection will do away with the special receptivity previously developed within the thyroid is not to be expected and recurrence of inflammatory activity may take place whenever in the future a new focus of infection containing the especial microörganisms is established. This, together with the further fact that there may coëxist two or more foci of infection, should be borne in mind when considering the prognosis in a case of Basedow's disease.

The difference between the subacute and acute type of Basedow's disease is only one of degree, representing different resisting powers on the part of the thyroid. In some cases, the microörganic invasion of an injured or functionally exhausted thyroid may result at once in a pronounced type of Basedow's disease. In other cases, the invasion results in changes in the thyroid which bring about exacerbations of various degrees of severity, and this type of dysthyroidism in the presence of a distant focus of infection may persist for years. No immediate disappearance of the hyperthyroidism follows the removal of the focus of infection. Usually three or four months have to elapse before the full effects of the operation are to be seen.

THE RETURN OF TENSION AND THE OCCURRENCE OF RETROCHOROIDAL HEMORRHAGE AFTER TREPHINING.[1]

By Dr. ARNOLD KNAPP, New York.

THE two conditions illustrated by the following cases, namely, the return of tension and the occurrence of a retrochoroidal hemorrhage, are in no way to be ascribed to the trephining operation *per se*, as they have been observed after any form of operation devised to reduce abnormal intraocular tension; and in the writer's opinion both of the accidents described in the following cases would have occurred in even a more aggravated form after an operation where a large incision of the sclera was required. The above title is therefore perhaps misleading.

A case illustrating the non-reduction of tension after operation is the following:

L. H., aged 59, had lost one eye from glaucoma, and in her remaining eye vision was reduced to movements of hand in the temporal field with a tension of 42. Trephining was done in the usual manner on June 26, 1917. A 1½*mm* disk was removed, and a large piece of iris excised. At the completion of the operation the tension of the eye seemed hard to the finger. On the following day this hardness was still present. On the second day after operation, on examining the area of the trephine-opening, a circumscribed bulging was found present. Tension measured 60 with the tonometer. A posterior sclerotomy was then performed. This was followed by a reduction of the tension and the bulging at the trephine-opening was flattened, and on July 7th

[1] Read before the Section on Ophthalmology, New York Academy of Medicine, January 21, 1918.

the tension registered 26. There was perception of light and on oblique illumination blood could be seen in the vitreous. On July 10th the tension had risen to 60 and the trephine-opening was again bulging. The anterior chamber was of medium but of uniform depth, so that there seemed to be no indication of a displacement of the lens. On July 11th it was decided to investigate the trephine-opening, and the conjunctival flap was again reflected. The opening in the sclera was found to be filled with a large bead of vitreous. This ruptured and a considerable quantity of fluid vitreous escaped. The flap was replaced and sutured. The healing after this was uneventful and the tension of the eye remained down until July 21st, and two days later the area of trephine-opening was again bulging and the tension was 80. The iris level was uniform, the lens was clear, no details could be seen in the fundus. On the following day another posterior sclerotomy was performed which lowered the tension; and on July 26th, the tension still being down, another trephining was practiced on the temporal side of the old wound without any accident. There was no reaction following this last operation, and apparently the tension has remained down. On August 4th the patient returned to her home in New York State with a tension of 20, perception of light, and blood still visible in the vitreous. A letter received on February 11, 1918, states that the eye has not given her any further trouble and that she can count her fingers.

Operation in certain exceptional and generally acute congestive glaucomas has been followed by an aggravation of the glaucomatous symptoms. This condition was recognized by von Graefe and designated "malignant glaucoma." It has been variously explained, generally by prolapse or traction on the ciliary body. Friedenwald[1] reported on a case of malignant glaucoma and collected the histories of twenty-four cases. In these cases, shortly after an iridectomy there was increase in tension with obliteration of the anterior chamber and all the symptoms of an intense congestive glaucoma together with a rapid loss of light.

Return of tension at some time after operation in chronic glaucoma has been observed in a definite proportion of cases irrespective of the operative procedure, and is generally due to the closing, or the lack of the proper establishment, of a

[1] Friedenwald, ARCHIVES OF OPHTHALMOLOGY, 1896.

filtrating scar. The persistence of tension in cases of chronic glaucoma after trephining is due, according to Elliot,[1] to either a dislocated lens or prolapse of vitreous, provided that no uveal tissue obstructs the trephine-opening. The usual cause for these complications is a vitreous hemorrhage which, while it may be facilitated by certain errors in the operative technic, is often beyond the control of the operator. Contributing causes are a relaxed suspensory ligament of the lens from an anteriorly displaced lenticular apparatus and degenerative changes in the vitreous body.

The dislocation of the lens shows itself by a change in the depth of the anterior chamber. This complication, which the writer has fortunately not encountered, is a very difficult one to deal with. Prolapse of vitreous is a more frequent complication and can be readily detected by a bulging at the trephine-opening, the anterior chamber remaining of uniform depth. In the cases of this condition which the writer has observed the tension did not go down and it was necessary to reflect the flap and incise the vitreous hernia. This was followed by the escape of a small quantity of vitreous; the healing, however, was uneventful, and the result satisfactory, except in the above-mentioned case where increase of tension returned and posterior sclerotomy and another trephining became necessary.

The following case is one of detachment and dragging of the retina into the trephine-opening, presumably due to retrochoroidal hemorrhage following a trephining for glaucoma.

The patient was a girl, aged 13, who presented the unfavorable combination of chronic glaucoma and subluxated lenses in both eyes, and stated that her sight had been poor for five years. The subluxated lenses were either due to the glaucoma or a coincident condition, surely not a cause for the glaucoma. With her myopic glasses (−7 D) the vision was R 20/200, L. 20/100. The pupils were irregular and eccentric. The depth of the anterior chamber was not uniform and there was a definite tremulousness of the iris. The anterior sclera in both eyes was unusually blue, suggesting a distension of this part of the eyeball. The tension with tonometer in both eyes measured from 60 to 70°. The fields showed a concentric contraction to

[1] Elliot, *Sclerocorneal Trephining*, II. ed., p. 111.

about 10°. Both optic nerves were cupped and atrophic. A brother of the patient was also nearsighted and the ocular tension varied from 38 to 40; the optic nerves were normal and the lenses were not dislocated. The little patient was admitted to the hospital and observed for a number of days. Miotics succeeded in reducing the tension only to about 50, and on Nov. 1, 1917, trephining was performed on the right eye under ether.

The operation was made particularly difficult on account of the necessity of keeping the eye pulled down and the free bleeding which took place from the scleral tissues. After removal of the disk the prolapsed iris was excised. This was followed by an immediate presentation of vitreous. As it was feared that this presenting bead of vitreous would interfere with filtration, it was cut away, and there was a slight escape of vitreous which promptly ceased. The fold of conjunctiva was replaced and sutured and the flap lay perfectly flat. On coming out the ether the patient suffered from a good deal of vomiting. At the first dressing, Nov. 3d, a large swelling was found present ballooning up the conjunctival flap, evidently a prolapse of vitreous. The pupil was fully dilated and on inspecting the fundus, a white band of tissue with blood-vessels (the detached retina) could be seen drawn into the trephine-opening. Two days later the area of detached retina had enlarged and the prolapse of vitreous underneath the flap was also greater. There was no sign of inflammation. In the lower part of the fundus there was a red reflex, but light perception was lost. Gradually in the course of a few weeks the bulging underneath the conjunctival flap became smaller, the eye remained somewhat red, and recurring hemorrhages were observed in the vitreous. At present the eyeball is becoming phthisical, the conjunctival flap over the trephine-opening is flat, and the retina can still be seen drawn to the region of the trephine-opening.

The retrochoroidal hemorrhage in this case presumably occurred during the vomiting after the operation as the patient came out of ether, for the escape of vitreous from the trephine-opening had ceased when the conjunctival flap was replaced and sutured. The case is, furthermore, but another example of the dangers of general anesthesia in glaucoma operations, particularly trephining and sclerectomy. An additional complication was present in the subluxated lenses which caused the prolapse of vitreous into the trephine-opening. The patient's other eye presents the same condition, and

though the tension remains well above normal, the writer has not felt justified in advising an operation after the above-mentioned experience. If, however, an operation should become necessary, iridotasis would seem to be the safest procedure.

FOCAL INFECTIONS OF THE EYE FROM THE INTESTINAL TRACT.[1]

A Preliminary Report.

By Dr. J. G. DWYER, New York.

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DURING the last few years marked attention has been paid to the consideration of infections of various parts of the body, due to a low-grade chronic infection in other parts, especially the teeth and tonsils, and a very considerable advance has been made in the treatment of those so-called focal infections by the treatment of the original focus. The number of such cases on record is enormous, is fast increasing, and nowadays with certain infections we look for the primary cause and eradicate it if possible. Among these focal infections are some lesions of the eye, that used to be classified under a general classification as rheumatism etc. We know now that there is probably no such disease as rheumatism *per se*, but that the symptoms classified as rheumatism are probably manifestations of some focus of infection. The work on focal infections of the eye due to infections of the teeth and tonsils have been reported by many observers and need not be touched upon. This paper will deal with focal infections of the eye due in all probability to the absorption of toxins from the intestinal tract, and a few suggestions as to the method of treatment now being given a trial in order to overcome these infections, as, in comparison with the teeth and tonsils, it is

[1] Read before the Section on Ophthalmology, New York Academy of Medicine, January, 1918.

impossible to treat surgically the intestine in the same way as the former two.

This investigation has been going on for about two years or more, and any statements that are made are based upon what we have learned in that time and are subject to change in the future, the whole idea of presenting the paper now being to direct attention to such infections and how possible to treat them.

At the beginning we were confronted with the fact that no two authorities were agreed as to what the intestinal contents should be in general—that is, the reaction, the amount of chemical constituents, the food detritus, and the bacteriology. This was and is a great difficulty and some may question our interpretation of what normal intestinal contents should be, but from an examination of hundreds of samples we have come to look for certain main characteristics, and I will begin by laying down what we look upon as the normal average intestinal contents.

First with regard to the reaction—Practically all authorities say that the normal feces is faintly alkaline to litmus. Now litmus is a rough and ready method of taking the titration, and we have found that with phenophthalein the reaction is generally slightly acid.

Food detritus—Just as in diabetes and nephritis the modern schools of medicine are aiming to test the efficiency of the body to assimilate the various foods, fats, carbohydrates, and proteins, so here we examined the detritus, having these three fundamental bases in mind. Our guiding principle here was to cut out of the diet those types of food that were not being assimilated—in other words, indol, skatol, and phenol. These products are normally present and unless abnormal in amount can be disregarded, but as the former two are known to be absorbed into the system, appearing as indican in the urine, and as they are products of protein metabolism, we paid special attention to these, as will be noted later.

The bacteriology—Here we are confronted with the biggest problem of all, as the intestine normally contains many various forms of bacteria, but here we pick upon one outstanding fact. We made no endeavor to identify the various forms of bacteria present as that would be an impossibility, but bearing

in mind the work of various investigators, especially Metchnikoff, special attention was paid to the presence or absence of the colon bacillus. Now, the colon bacillus appears in the intestine a few days after birth and is usually found there throughout life. Again, the colon bacillus is Gram-negative—that is, staining a different color from that of the other bacteria usually found, these latter being Gram-positive with very few exceptions, and hence we had a ready means of comparison. The ptomaine producers are usually Gram-positive large bacilli, producing either acid or alkali, depending upon the group. Many of them are of the anaërobic varieties, such as the bacillus aërogenes capsulatus etc.

With these facts in mind and trying to narrow the whole affair down to a practical working basis, the following routine was carried out. The intestinal contents were examined as to their reaction, their content of indol and skatol, the food residue and the bacteria. Besides these cardinal principles, other side factors were noted. If the contents were found to be practically normal, these were noted as controls. Now in most of the patients examined, the contents could be classified under two headings, as to whether they were highly acid or alkaline. In both such classes the colon bacilli were either entirely absent or present only in very small numbers, the other bacteria being practically Gram-positive. This was true whether the reaction was to either extreme, as in a highly acid medium the colon bacillus cannot live, although it is an acid producer, and of course it is killed off in a highly alkaline medium. It was always found that in both highly acid and highly alkaline specimens the indol and skatol content was high and there was always a high percentage of indican in the urine. The following methods of treatment were then adopted: In the highly acid specimens, an endeavor was made to alkalinize the contents by the use of irrigation of 1% sodium carbonate solution, and then to practice colon transplantations in order to approach the normal. At the same time the patients were put on a rather free diet, cutting out however the food, such as meat, that was not completely assimilated—in other words, the tolerance for the three fundamental foods was established as far as possible. In the highly alkaline specimens, irrigations with sugar of milk were given and then the colon bacilli trans-

planted. At the same time, the Bulgarian bacilli were given by mouth, the whole idea being to approach the average normal. Sugar of milk was also administered by mouth in such cases to provide a suitable pabulum for the colon bacilli. At stated intervals, examinations were made and the treatment repeated until we got good growth of the colon bacillus.

A few of the eye cases will now be reported. The types of cases chosen were those that would not respond to any other form of treatment, cases that were thought to be focal infections, but treatment of the teeth and tonsils was unavailing. They were all cases that had lasted for weeks, better one day and worse another, but no real improvement.

CASE NO. 12.—Charles B., had lost the sight of the right eye on account of a low-grade ulcerative keratitis that had lasted six months and left the eye in a badly damaged condition with the pupillary area of the cornea covered with a scar. He had been treated for this eye by some of the best ophthalmologists in the city, and had been an in-patient of one of our hospitals for weeks. When I saw him, he had been in our wards for some weeks with the same condition in the other eye, the history of this lesion dating back two months. Every test had been negative and he was put on anti-specific treatment, as it seemed the most likely thing. Upon taking his history, we elicited the fact that he had had intestinal poisoning for years and could not get any relief, and he volunteered the information that the other eye had become quiet as soon as he had gone to a stomach specialist. The condition of the eye at first examination was as follows: A diffuse low-grade keratitis with a low-grade iridocyclitis; in spite of all measures, the pupil could not be kept dilated, but would dilate under the atropine and then contract again. One noticeable point was that the man's face was covered with an acne rosacea. Immediate examination of his intestinal contents was made and the following found: Reaction highly alkaline, indol and skatol five plus (+ + + + +) and bacterial smears totally Gram-positive. The treatment above outlined was carried out, and inside of two days the eye condition was much better, pupil remaining dilated under cycloplegic, and within a week he went home with a perfectly quiet eye. The acne cleared up and when he last reported, after six months, he was in splendid condition, with a perfectly serviceable eye.

CASE NO. 18.—J. MC., a man suffering for nine months from a plastic iritis of low grade in both eyes, which kept

him from business and made a semi-invalid out of him. He had been under the care of competent ophthalmologists in the city, had had his teeth radiographed and the diseased teeth removed, had his tonsils out, and still the condition persisted. The same condition was found here, and within eight days the eyes had quieted down, and the last report I had, some months after the lesion, he was in excellent condition.

CASE NO. 19.—S. consulted me about his eye; he was suffering from an intense plastic iritis, that had lasted two months, and had had all the accepted methods of treatment. He cleared up rapidly with the treatment outlined for highly acid stools.

In conclusion we would close with a few references to the types of cases. By far the largest number of cases of choroiditis, retinitis, iridocyclitis, glaucoma, and such are diagnosed by us as to the condition present, but we cannot go any further in the etiology or in the treatment. The cases run their course in spite of the treatment adopted. It would be ideal, if we could take such cases and study them extensively so as to arrive at the cause. The reference of eye infections to the intestinal tract is not new, as evidenced by the splendid articles, among others of Herter and Smith published in 1894, reciting there cases of ophthalmoplegia, low-grade conjunctivitis, etc., cured by treatment of the intestinal tract. My attention was called to this article by Dr. Coffin, who incidentally was the means of my attention being directed to the intestinal tract on account of a case that he will describe in detail.

In conclusion, I would like to state that we don't claim anything new at all, it is simply an experiment along this line, but that the results in the series we have treated and which now number sixty-seven, were in the great majority of cases very striking, and it seemed well worth while to investigate along these lines. I wish to thank the men who have studied these cases with us and who placed them at our disposal, and to thank Mr. J. J. Connellan for the way in which he carried on the examinations.

THE LIGHT PUPILLARY REFLEX, ITS PATH, AND ITS ABOLITION CALLED IMMOBILITY OF THE PUPIL TO THE LIGHT REFLEX, AND REPORT OF A CASE OF UNILATERAL ARGYLL-ROBERTSON PUPIL, IN WHICH CONSENSUAL REACTION EXISTED IN BOTH EYES.

By Dr. ANTON LUTZ, Havana.

(With eight figures in the text.)

A UNILATERAL Argyll-Robertson pupil must be considered even to-day as a rare anomaly. There exist, so far as I have been able to ascertain from the literature of the subject, only five cases of unilateral immobility to light with conservation of the consensual reaction in both eyes. The rarity itself would justify the publication of any new case of this last form. These cases are of the utmost importance in relation to the whole physiology and pathology of the pupillary reaction, and it will therefore be convenient to precede its publication by a short description of what we know to-day about the light reflex, its path, and its abolition called immobility of the pupil to the light reflex, or "Argyll-Robertson phenomenon."

I

DESCRIPTION OF THE LIGHT REFLEX.

As far as we know, the first exact modern description of the light reflex of the pupil, which was even known to Galen, dates from Verdier in 1751, who observed the contraction of the pupil on the incidence of light and who spoke of circular and radial muscles of the iris. The consensual light reflex or the

contraction of the pupil of the fellow eye dates from Whytt in 1752. Porterfield in 1759 called attention to the fact that the direct light reflex is stronger than the consensual one. Lambert in 1760 observed that the light reflex is stronger when the illuminated area is larger. E. H. Weber in 1852 observed that the macula has a stronger pupillo-motor effect than the periphery. Babinski, in 1900, noted that the adaptation of the retina has a pronounced influence on the amplitude of the light reflex. After keeping a patient for a certain time in a dark room, the light reflex can even be made visible in cases where it seemed to be abolished. The influence of the adaptation is so very strong that in normal persons a transitory anisocoria can be produced artificially by keeping one eye covered for a certain time.

The light reflex begins with the first day of life, even in prematurely born children. Magitot tells us that the light reflex begins at the end of the fifth fetal month. First, the pupillo-contraction reflex appears, in the direct as well as in the consensual; some weeks later the pupillo-dilatation reflex develops. In healthy persons it is not abolished through age. In old men, whose pupils are often miotic, it may be difficult to observe the contraction of the pupil; but we know to-day, through the systematic investigations of Winaver Bronislas on 180 old people from 60 to 95 years, that it is always present, and that its observation can be made easier by the use of a few drops of cocaine.

The light reflex consists in a contraction of the pupil when the illumination is increased, and further, in a dilatation of the pupil on a reduction of the illumination. In healthy persons incidence of light produces contraction of the pupil of the same side as well as of the pupil of the non-illuminated fellow eye. The contraction of the pupil does not show itself simultaneously with the incidence of light, but begins about 0.4 to 0.5 second later (Listing), and reaches its maximum after another one-tenth of a second. Vervoot (1900) showed its dependence on the quantity of light: an object as large as 1 illuminated with intensity 4 produces the same degree of pupillary contraction as an object 4 times larger but illuminated 4 times less. Ovio (1905) formulated the law in the following terms: the surface of the pupil is in inverse proportion to the square

root of the light intensity. Monochromatic light of different light intensity has also different pupillo-motor effect. Roentgen-rays have no influence on the pupil. The influence of light intensity is also shown in the consensual reaction: In healthy persons, upon covering one eye the diameter of the pupil of the fellow eye is increased from ¼ to ¾*mm*. Schlesinger fixed as the threshold of the pupillary reaction a light intensity of 0.70 meter candle; this is normal for healthy persons of about 35 years of age; children have a little lower threshold; older adults a higher one. The pupils become tired, which is seen in a minor degree of contraction and the need of more light intensity and more time to produce the light reflex. The light reflex is always unconscious and involuntary. Hypnotic sleep (Janet) is without influence on the light reflex.

II.

THE PATH OF THE LIGHT REFLEX.

As far as we know to-day, the path of the light reflex may be divided as follows:

A. Sensorial Motor Arc.

1st. Sensorial afferent path, responsible for pupillary contraction:

Retina; optic nerve; chiasma; optic tract; corpus quadrigeminum anterius; fasciculus tecto-bulbaris.

2d. Efferent pupillo-contraction path:

Nucleus of the sphincter; nervus oculomotorius; radix brevis; ganglion ciliare; posterior ciliary nerves; the sphincter iridis muscle.

B. Centers.

Territory of the nucleus of the oculomotorius nerve.

C. *Sensory Motor Arc.*

1st. Sensory afferent path, responsible for pupillary dilatation:

All sensory cranial and spinal nerves with their correspondent spinal ganglions, especially the trigeminus, acusticus, and sensory nerves of the arms, chest, and neck.

2d. Efferent pupillary dilatation path:

Mesencephalon; medulla; lateral columns of the cord; ventral roots of the first three thoracic nerves; rami communi-

cantes; truncus sympathicus; superior cervical ganglion; anterior branch of the Gasserian strand; Gasserian ganglion; first branch of the trigeminus; long ciliary nerves; dilatator muscle.

The path of the light reflex is at present known only in a very uncertain manner, and it is very interesting to make a comparison of the different opinions and various clinical as well as anatomical statements concerning it. Let us follow it step by step.

A. Sensorial Motor Arc.

1st. Sensorial afferent path.

It is obvious that the sensorial afferent path is responsible for pupillary contraction following an increase of illumination. It is doubtful if it can be made responsible for pupillary dilatation following a reduction of the same. It begins doubtless, in:

(*a*) *Retina.*

(*aa*) Most of the authors sustain that the whole retina is responsible for the light reflex, *e.g.* Lapersonne, Parsons,

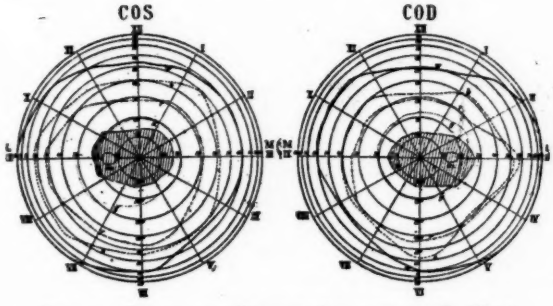


FIG. 1.—Campus pupillo-motoricus retinæ (C. Hess).

Uhthoff. Against this opinion C. Hess in 1907 brought forward the hypothesis, based on ingenious experiments that there exists a well marked pupillo-motor zone in the retina, which is alone responsible for the light reflex, and which includes the macula and a certain area around it about 3*mm* in diameter. Schlesinger believes this area to be 4*mm* in diameter. Heddæus in 1886, stated that only the macula has a pupillo-motor effect.

Against the theory of Heddæus–Hess we have to take into account the cases with large central scotomata, as well as those with peripheric remnants of the visual field after inflammatory destruction of the optic nerve, in which the light reflex persists. Furthermore, against it we find that anatomically we do not know of any difference in the structure of the retina in this zone and of the remaining parts of the retina.

It remains certain that the macula has the strongest pupillomotor effect, and that this effect decreases rapidly towards the periphery.

(*bb*) Most authors believe that the light reflex begins in the visual cells, *i.e.* in the rods and the cones. Uhthoff expresses the opinion that the light reflex begins in the inner parts of the retina, and bases his idea on the fact that the light reflex is not always abolished through destruction of the outer retinal layers, *e.g.* in retinitis pigmentosa and detachment of the retina. But I think that in all such cases it remains uncertain whether the outer layers of the retina are in reality totally destroyed. The same observations induced Schirmer to see the origin of the light reflex in the so-called "amacrine cells of the retina," denying importance to the visual cells in respect to the light reflex. Against this opinion of Schirmer speaks the fact that the amacrine cells though abundant in the border of the macula are lacking in its center where we have the strongest pupillo-motor effect. The amacrine cells or "spongioblasts" have been specially studied by Ramón y Cajal. He gave them the name "amacrine cells" because they have no long axis-cylinder (α = without, μακρος = large, ἶς = fiber); they are interposed on the one side between the centrifugal cylinder fibers which come down from the cortex and the basal ganglion to the retina, and on the other side between the large ganglion cells of the innermost retinal layer. Therefore we have to consider them as members of a centrifugal chain of neurons. In addition, between these amacrine cells are interposed other cells which have an ascendent axis cylinder ending in a knot in the external plexiform layer. We find that these last cells are in connection: first, by their inferior dendritic terminations with the centrifugal fibers as well as with the amacrine cells; and secondly, by their ascendent fibers with the articulations between cones and rods on one side,

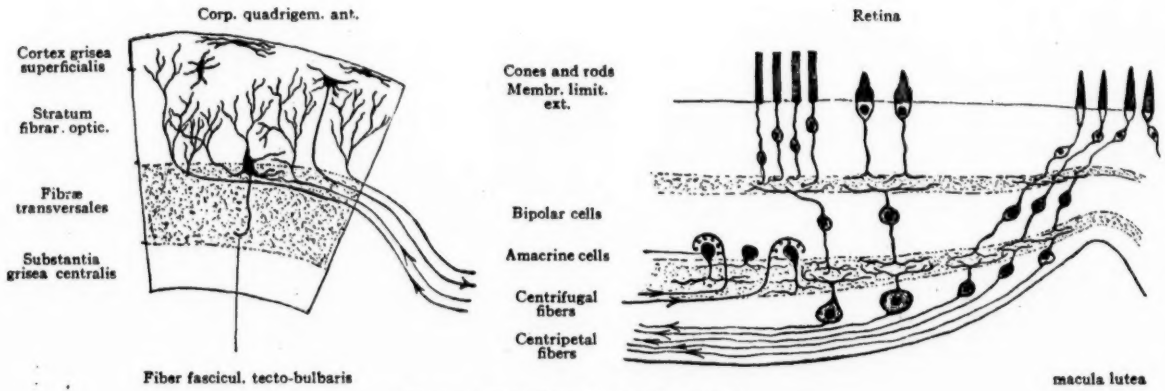


FIG. 2.—Sketch after S. Ramón y Cajal.

and the bipolar cells on the other side. According to Ramón y Cajal, these last cells belong to the centrifugal neuron chain, and complete the theory of Duval, which is the following: "The centrifugal fibers bring the stimulus down from the cortex and the basal ganglia, and produce a contraction of the ramifications of the bipolar cells and the ganglion cells; consequently, the surfaces of the dendrites come into a more intimate contact, the adaptation is more exact, and this facilitates the centripetal nerve current." This may be illustrated by a small sketch from Cajal.

Therefore, as far as our knowledge stands to-day, we have to accept that the amacrine cells belong to a centrifugal neuron system; if we consider further that these amacrine cells are found only in the territory of the second retinal neuron, corresponding to the spinal neuron of the spinal nerves, and that we never find them in the territory of the first retinal neuron, we cannot regard them as responsible for the origin of the light reflex. Lapersonne also believes that the amacrine cells play a rôle in the voluntary adaptation of the retina. We know that the amplitude of the light reaction depends upon the retinal adaptation, and we can admit that the amacrine cells play a rôle in the light reaction. The most plausible hypothesis on the difference of visual and pupillary fibers, is perhaps that set forth by Ramón y Cajal (1911): he called attention to the fact that in the innermost layer of the retina there are two different forms of ganglion cells; some are unistratified and are in connection with the shortest bipolar cells, which are connected with only one cone or one rod; this neuron chain is reserved for impressions of localization, and represents the individual path of the visual mental image to the brain. On the other hand, we have multistratified ganglion cells, which are connected with several multistratified bipolars receiving the impression of different cones and rods; these neuron chains would form the origin of the reflex path. In favor of this hypothesis is the embryological fact that the differentiation of rods and cones begins just at the end of the fifth fetal month, when according to Magitot's investigations on prematurely born children, the light reflex begins to develop. This theory would also explain the difference between the thick and the slender fibers in the optic nerve. It would also

serve to explain why the light reflex persists in cases of detachment of the retina, for example, after vision had been lost. Furthermore we have to remember that C. Hess in systematic experiments with light of different wave lengths, ascertained that not only the visual but also the pupillo-motor receiving apparatus is situated in the outer portions of the cones in day birds.

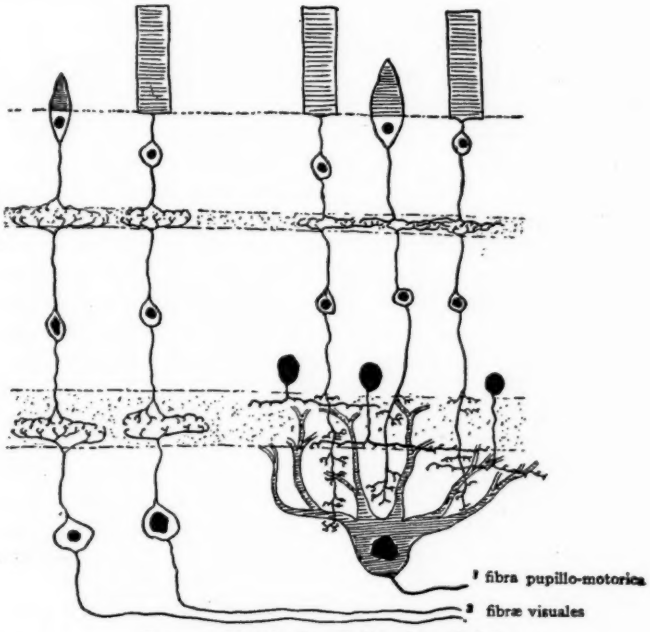


FIG. 3.—Sketch after S. Ramón y Cajal.

(*b*) *Optic Nerve.*

There is no doubt that there are both visual and pupillary fibers in the optic nerve. By cutting the optic nerve we obtain complete abolition of the light reflex (amaurotic light immobility). Key and Retzius could find in men two different kinds of fibers,—thick ones and slender ones Westphal found that the thick fibers receive their medullary sheaths sooner than the slender ones. Monakow found that the thick fibers

passed almost entirely to the corpus quadrigeminum anterius, but not the slender fibers. It is therefore probable that the slender ones are concerned with visual sensation, and that the thick ones carry the afferent pupillo-motor impulse. But this is not yet proven, and authorities like Vennemann do not accept any special pupillary fibers. In favor of the acceptance of special pupillary fibers, we have to record the cases where we find light reaction of the pupil present, after complete loss of visual sensation, *e.g.* from inflammation of the optic nerve. Very interesting in this connection, is a case of Piltz, where the pupil contracted to light in a patient who had been completely blind for nine years from atrophy of the optic nerve. In compression of the optic nerve the pupillary reflex is much less affected than the vision, which may indicate that the pupillary fibers are more resistent. Furthermore the reaction of the pupil returns usually very much sooner than vision, when improvement begins after acute inflammation of the optic nerve. These considerations explain why we cannot accept the theory that the light reflex is only conducted by collaterals of the visual fibers—which does not seem improbable to Parsons; otherwise, visual sensation and light reflex should always be abolished simultaneously.

From purely theoretical considerations, in order to explain the light reflex, Ramón y Cajal investigated the chiasm for fibræ bifurcatæ. He readily found them there, and believes that they are responsible for the conduction of the light reflex. According to Henschen these fibræ bifurcatæ belong to the macular fibers. There are only a very small number of them, and they have not been found in man.

(*c*) *Chiasm.*

It is universally accepted that the pupillary fibers undergo a partial decussation in the chiasm exactly as do the visual fibers. This statement can be found in every book on ophthalmology or neurology. It is natural that this acceptance was suggested by the proven partial decussation of the visual fibers. Theoretically, we can consider three possibilities:

(*aa*) *Total crossing of the pupillary fibers in the chiasm:* This possibility is excluded by the clinical observations of heteronymous hemianopsia in which the pupillary reaction is almost never abolished. Mitchell published a case of complete

section of the chiasm by a tumor, where the pupillary reaction was present, nevertheless the chiasm was separated in two parts. It is further proven by the experiments of Bernheimer (monkey, 1898) and Bechterew (dog) where after having sectioned the chiasm in a sagittal direction, the presence of both the direct and consensual light reaction in both eyes could be demonstrated. These experiments and clinical observations, besides pointing towards partial decussation of the visual fibers, also tend to prove a partial decussation of the pupillary fibers, but do not exclude by any means the third possibility, *i.e.*, that the pupillary fibers do not undergo any decussation.

(*bb*) *Partial decussation of the pupillary fibers in the chiasm:* Parsons writes that this is proven by the hemiopic pupillary reaction of Wernicke. But it is well to bear in mind that Wernicke conceived the theory of the hemiopic pupillary reaction out of the hypothesis of a partial decussation of the pupillary fibers, and it is not logical to prove a hypothesis by its own unproven supposition. Harris records that in all lower animals (fishes,—lower mammalia) which are characterized by a total decussation in the chiasm, we have only a direct light reaction, but no consensual one, and that in all animals with partial decussation (higher mammalia—man), we have a consensual light reaction as well as a direct one. The rabbit has a partial decussation and a direct light reflex, but no consensual reaction. One could be tempted to conclude from these statements that the consensual reaction is founded on the presence of non-crossed pupillary fibers.

Most authors speak of the *hemiopic reaction of the pupil* (also called hemikinesis by C. Hess) with so much circumspection that one involuntarily gets the impression that these authors have never been convinced of the existence of hemikinesis. There are special methods necessary, as those of C. Hess and Clifford B. Walker, to avoid the disturbance through light dispersion and retinal adaptation, and to observe that most important condition of equikinetic parts of the retina. There are only a few physicians who have observed this reaction very clearly. Theoretically, we can find hemikinesis only in hemianopsia anterior, *i.e.* through total destruction of the optic tract between chiasm and corpus quadrigeminum

anterius. This space is perhaps only one fifth of the length of the whole optic tract from chiasm to cortex. This proportion, and the fact that most hemianopsiæ are produced by hemorrhages in the internal capsule or in traumatism of the occiput, explain the small number of published cases of hemianopsia anterior. Traumatism in this region in most cases kills the patient. Lenz (1909) gathered all the cases of hemianopsia, and tells us there did not exist a definite case of complete section of the optic tract in which microscopical examinations had been made. A. Jess (1913) published from the clinic of Würzburg an article on the practical value of hemikinesis, which he considers, on account of one positive case, as a sure diagnostic aid in the localization of brain affections. The positive case of hemikinesis which he reports was followed by an autopsy. In the report he only mentions right hemianopsia with preservation of the macula, choked disk in both eyes, and right hemiparesis involving the facial, hypoglossus, and trigeminus nerves; there is nothing said as to whether the section of the optic tract was complete and the preservation of the macula speaks in favor of an incomplete section. Lenz (1914) published later another article on hemianopsia and reported six cases of hemianopsia anterior: one case could not be examined for hemikinesis on account of immobility of the pupil to the light reflex in both eyes, from syphilis; in two cases he found no hemikinesis, the reaction was normal; in three cases there was hemikinesis, and of these three only one showed a complete hemianopsia, though there was a little remnant in the abolished visual field near the macula. The two others were cases of hemianopsia for colors only (hemiachromatopsia), which Lenz considers as lesions of minor severity. It is, therefore, all the more surprising that Lenz could find hemikinesis, for we must admit that real hemikinesis should only be possible in complete destruction of the optic tract which conducts the pupillary fibers. These observations of Lenz are in conformity with the systematic researches of Clifford B. Walker, who examined fourteen cases of hemianopsia in the clinic of Cushing (1914). He made the tests with all precautions and with a specially built apparatus; he could find hemikinesis present in anterior hemianopsia as well as in posterior. It was found in cases having

every clinical evidence of being purely posterior cases; one of the most striking examples was a case of posterior hemianopsia. He also found it in rather early stages of incomplete hemianopsia of both bitemporal and homonymous types. The most important fact is that hemikinesis was present in a completely normal eye, after having lowered the adaptation of one half of the retina (one half of the retina was blinded by looking at the edge of a large bright surface and a difference in the pupillary reaction with the rotatory shutter was obtained). One can conclude from these observations of Walker that the adaptation of the retina is of the utmost importance for the light reflex, but we must also conclude that the hemiopic pupillary reaction is such an uncertain and scarcely known phenomenon that it can be by no means a proof for such an important thing as semi-decussation of the pupillary fibers.

The observations of Clifford B. Walker are confirmed by Déjerine and Jumentié (1914) who observed a case of hemianopsia posterior followed by autopsy, in which both observers had clearly noted the difference in the pupillary reaction of the healthy, and the injured, visual side. Another point we have to consider is the following: In publications on hemikinesis we find mostly positive hemikinesis without any note of whether it was found in both eyes, and to the same degree Theoretically we have to assume that it would be so in every case; further clinical observations are necessary for the evidence to be considered conclusive.

In favor of a partial decussation of the pupillary fibers in men, we have the experiments of Trendelenburg in cats (1911); by cutting one optic tract in a cat he could observe hemikinesis and mydriasis of the contra-lateral eye. But regarding the fact *e.g.* that lower animals have total decussation, it seems to me not allowable to conclude out of these experiments that we have semi-decussation of the pupillary fibers in the chiasm in man. Much more convincing is a case of anterior hemianopsia observed by Pierre Marié and Ch. Chatelin (1915); lesion of the right tract by a piece of metal, left hemianopsia observed for one year, limiting line going exactly through the point of fixation and left pupil more dilated. Examination for hemikinesis made with all precautions at different times showed: "Right eye: if the light falls on the blind half of the

retina, the contraction of the pupil is good but does not persist; if it falls on the seeing half of the retina, the reaction is normal. Left eye: if the light falls on the blind half, no pupillary contraction follows: if it falls on the seeing half, the contraction is good but does not persist." These observations show that the hemikinesis is not equal in both eyes, and one could be tempted to deduce that most pupillary fibers undergo semi-decussation, consequently hemikinesis is more pronounced on the contralateral side, because the contralateral eye has lost the nasal retina, which includes a larger part of the pupillo-motor zone (area between disk and fovea) than the temporal retina. But such deduction would be in contradiction of the fact that in hemianopsia bilateralis, the pupillary reaction shows no alteration and that sagittal cutting of the chiasm remains without influence on the light reflex. In addition it is good to bear in mind that there exists a certain variation in men, in the degree of the chiasm decussation of the visual fibers. There are observations of total crossing of the chiasm as well as of congenital absence of any chiasm crossing (Cushing and Walker, *Brain*, 1914).

Ramón y Cajal showed by a very ingenious theory that lower animals have a complete crossing of the visual fibers, and that higher animals have only a partial decussation,—to make possible simultaneous vision. If this theory is true, there is no necessity for semi-decussation of the pupillary fibers.

We have therefore to consider a third possibility:

(*cc*) No crossing of the pupillary fibers in the chiasm: If we ask ourselves, first if there exists any fact which would render impossible the admission of this non-decussation, then we must admit that so far there is no convincing fact reported which would permit us to discard absolutely this view. What would be the consequences of such a statement? There are two: first, in cases of binasal hemianopsia, we should have a complete abolition of the light reflex; and, secondly, in cases of complete destruction of the tract, we should get homonymous hemianopsia with pure light immobility of the pupil of the same side. Lange published (1913) as far as I know the first well-studied and surely recognized case of hemianopsia binasalis: it was a young man in whom neurological examina-

tion could not bring out an indication of any abnormality and who showed a complete hemianopsia binasalis for three fourths of a year, together with an external squint which is often present in reduced vision, and who further had—what is most important— a complete abolition of the pupillary reflexes for light and convergence. Now it seems to me quite natural that the reaction on convergence is abolished, since there is no object for it; it is well known how difficult it is for blind people to converge when we do not touch their nose, and so on. The most striking fact was that the pupils did not react to light, the nasal retina in both eyes being quite intact, and vision reduced to fingers at 4*m*. A technical error can be excluded in the investigations of such an experienced oculist as Lange. We have two further observations on binasal hemianopsia with indications on the light reflex, but these two cases are not without complications. Charles R. Heed and George E. Price (1914) observed one case which they considered as a tabetic manifestation; the binasal hemianopsia was present for three months, the direct as well as the consensual light reflex being abolished in both eyes, the reaction on accommodation being sluggish; there existed slight Romberg, positive Biernacki, loss of Achilles tendon reflex, and lymphocytosis of the cerebrospinal fluid. Shoemaker (1905) described a case of binasal hemianopsia; the pupils were equal and the irides reacted rather sluggishly to light, Wernicke being imperfectly present. The second consequence would be, as mentioned before, a pure light immobility of the same side. As no certain case of complete destruction of the tract is on record we do not know anything about it, pro or contra. Hemianopsia visualis and pure light immobility of one eye would then be the symptoms of the complete destruction of the tract. "As far as I know, these have not been observed, and further clinical observations are required. With these considerations I do not wish to affirm that there does not exist decussation of the pupillo-motor fibers in the chiasm. I wish only to show that we cannot exclude the possibility of non-decussation, as long as the semi-decussation is not absolutely proven, and that in further anatomical researches and clinical observations, we have to take in consideration the possibility of non-decussation in the chiasm. We can therefore never say that the partial

decussation of the pupillo-motor fibers in the chiasm is proven by the hemikinesis; we can only suppose that it is probable by analogy with the visual fibers. Only after having given proof that non-decussation of the pupillary fibers in the chiasm is excluded, can we accept by exclusion the semi-decussation of the pupillary fibers in the chiasm.

(*d*) *Optic Tract.*

Opinions are also divided as regards the optic tract (Figure 4).

This sketch shows the most accepted description of the path of the light fibers in the tract. According to Ramón y Cajal, v. Monakow, Van Gehuchten, Testut, etc., the pupillary fibers follow the optic tract as far as the corpus geniculatum externum. There, the visual fibers separate from the thick pupillary fibers, the visual fibers going into the corpus geniculatum externum, and pulvinar, and only very few pass through the corpus geniculatum to the tuberculum quadrigeminum anterius. The pupillary fibers leave the tract in front of the corpus geniculatum externum and go in their totality to the corpus quadrigeminum anterius through the brachium conjunctivum. This is proven to-day (1913) by the experiments of Karplus and Kreidl who cut in a monkey and in a cat both brachia conjunctiva and corpus quadrigeminum anterius; the animals survived the operation about one month and during that time the light reflex could not be detected, while the reactions on convergence and on pain were normal. Bechterew believed (1883) that the pupillary fibers leave the tract just behind the chiasm, entering the stratum griseum, and that they reach, following the bottom of the third ventricle, the oculomotor nucleus. He was led to this opinion by the existence of the ganglion opticum basale (Meynert-Huguenin), which is a conglomerate of ganglion cells in the chiasm. On each side of the chiasm is one ganglion which is in connection with the retina of the same side, and whose continuation is found in the tuber cinereum. This neuron would therefore represent a direct or non-decussated reflex path in the optic nerve. Trendelenberg (1911) could cut these latter fibers in cats, but the pupillary reaction did not show any alterations afterwards. Bechterew gave up this idea later, sharing those of Van Gehuchten (1900) that the fibers leave the tract before the

corpus geniculatum externum, and enter then into the posterior part of the thalamus and reach the oculomotor nucleus

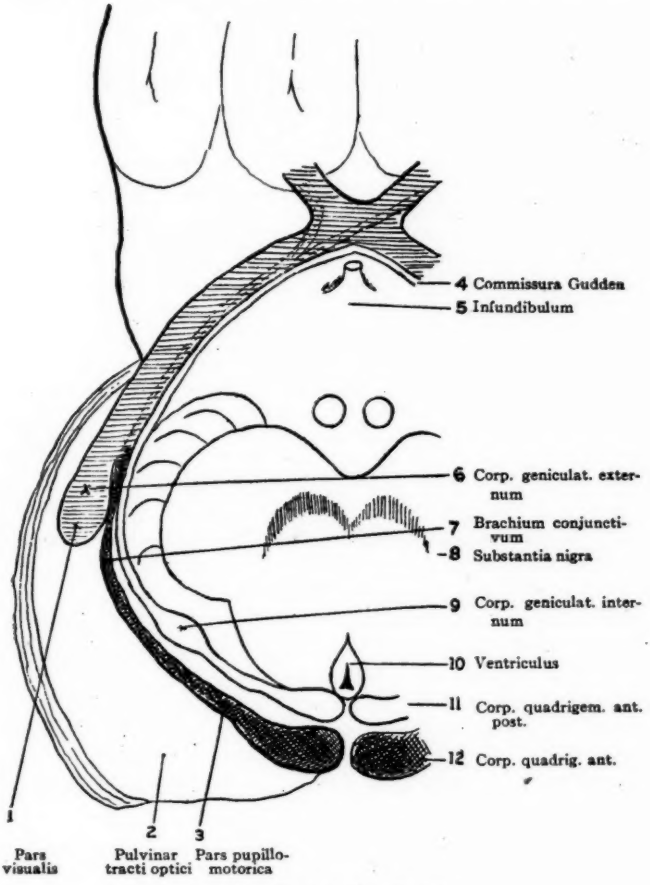


FIG. 4.—Sketch after Testut.

through the commissura blanca posterior. After the description of Déjerine (1914) these fibers originate in the pulvinar. Bernheimer (1899) concluded from embryological studies that the pupillary fibers go in part direct from the tract through the

corpus quadrigeminum to the nucleus, while other parts enter in connection with the gray matter of the corpus quadrigeminum. Against the acceptance of this view stand the systematic investigations of Probst, who never could find that the degenerations following enucleation of eyeballs go further than the corpus quadrigeminum anterius. Therefore, we have to accept that in the corpus quadrigeminum anterius begins a new neuron.

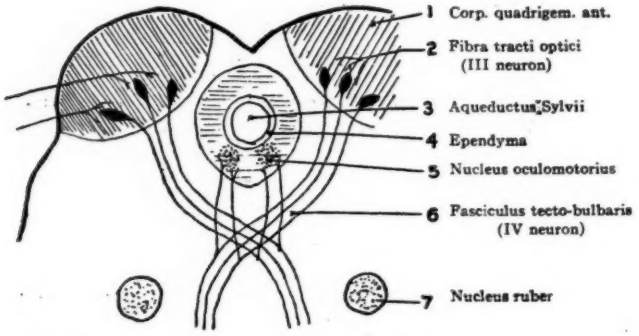


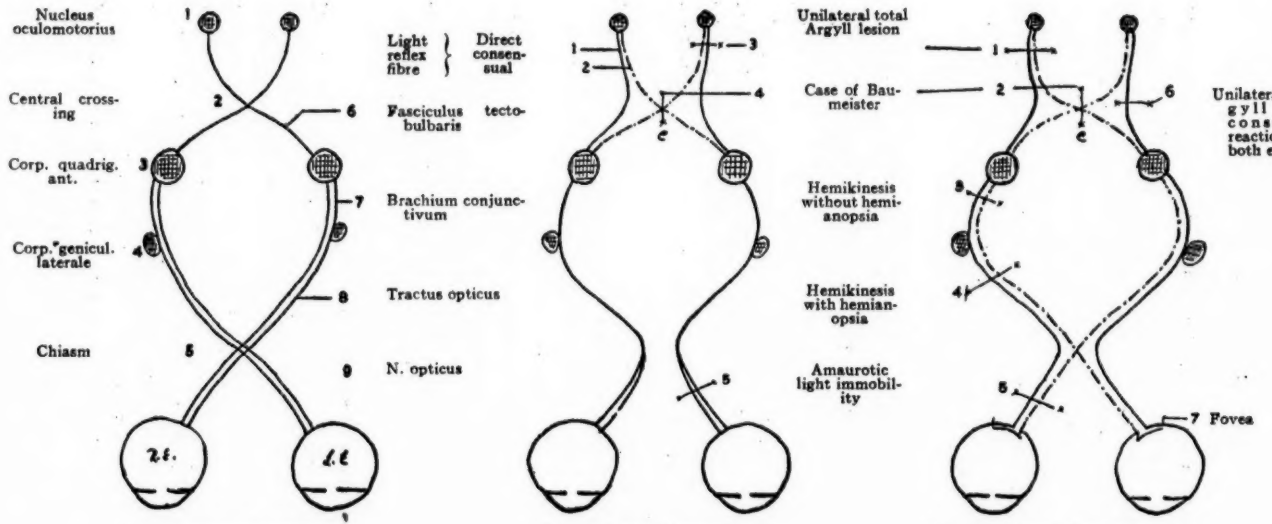
FIG. 5.—Sketch after Testut.

(*e*) *Corpus quadrigeminum anterius.*

Van Gehuchten (1908) believes that the corpus quadrigeminum anterius is the reflex center, because it does not give origin to ascendent fibers. Others, like Testut, accept ascending fibers, but nevertheless consider the corpus quadrigeminum anterius as the reflex center. Van Gehuchten as well as Testut believes that the pupillary fibers go to the ganglion cells of the corpus quadrigeminum anterius and enter there in connection with the fasciculus tecto-bulbaris.

This fasciculus descends from the top of the mesencephalon, goes around the aqueduct of Sylvius, across then to the other side, and enters in the fasciculus longitudinalis posterior; in its path the fasciculus tecto-bulbaris gives collaterals to the ganglion cells of the nucleus oculomotorius of both sides, as well as to the other motor nuclei which play a rôle in the movements of the eyeball.

Ramón y Cajal (1911) gives the following description of this



I. Lower animals with no consensual light reflex

II. Case of chiasm tumor or congenital absence of the chiasm crossing. There exist direct and consensual light-reflex

III. Semi-decussation of the pupillary fibers in the chiasm!

FIG. 6.

last part of the afferent pupillo-motor path. He says: "The third retinal neuron passes with its axis cylinder to the tuberculum quadrigeminum anterius: there it enters into connection with the fibers which form the commissura blanca cerebri posterior, which is situated just in front of the corpora quadrigemina anteriora. These fibers then pass down either directly or after crossing to the other side, and enter into connection with the nucleus interstitialis, which is the origin of the fasciculus longitudinalis posterior; this fasciculus longitudinalis posterior is the last stage, because it brings the light stimulus to the nucleus of the oculomotor nerve as well as to the other nuclei which are responsible for the motility of the eye."

The communication between the corpus quadrigeminum anterius and the oculomotor nucleus takes place through the fasciculus tecto-bulbaris, and according to Testut through the commissura blanca posterior and the nucleus interstitialis according to Cajal. We have to consider the possibility that the first could be the path for the direct light reaction, and the second the path for the consensual light reaction. The first one has only one neuron interposed, the second has two. For this reason it seems to me more correct to make the fasciculus tecto-bulbaris responsible for the light reflex, and the route through the commissura blanca posterior, for the reflex movements of the eyeball, *e.g.* when a visual impression falls on the periphery of the retina. This opinion is confirmed by the experiments of Harriss (1903), who made two sections through the commissura blanca posterior, with the following result: In the first three days a marked mydriasis was noticeable; this disappeared on the fourth day, after which there was a completely normal reaction.

It seems natural to me to make responsible for the consensual light reaction, collaterals of the pupillary (not visual) fibers for the direct light reaction.

These considerations show us how little known is this last part of the afferent pupillo-motor path, but there is another point to which we have to call attention: it is the partial or total decussation of the pupillary fibers in this last stage of the afferent path. The efferent pupillo-motor path does not undergo any decussation and the center is situated in the oculomotor nucleus. Lower animals show a total crossing of

the optic nerves; they have a direct light reaction, but no consensual one. So we are forced to accept as a consequence of the total crossing in the chiasm a second total crossing before the afferent path reaches the center; if that were not so, that is to say, if we had no central crossing, we could only have a consensual reaction, but never a direct light reaction. Applying the same considerations to animals with partial decussation of the visual fibers in the chiasm there may be different arrangements of the pupillary fibers in the chiasm.

A satisfactory explanation of the pupillary reaction can only be given in accordance with the last sketch, in which we find a partial decussation of the chiasm and semi-decussation in the center, showing that each half of the retina is in connection with both sides of the photomotor nucleus. A mere glance at the preceding sketch shows how simply the connections of the afferent pupillo-motor path with the center takes place, if we do not accept semi-decussation of the pupillary fibers in the chiasm.

A comparison of these different opinions on the route of the light fibers appears to me to be very important. From them we draw the logical conclusion, that, by lesions in different parts, the following possibilities may occur:

(A) A lesion between corpus geniculatum laterale and corpus quadrigeminum anterius causes:

1st. Hemikinesis without hemianopsia, if we accept semi-decussation of the pupillary fibers in the chiasm. This phenomenon has, as far as I know, not yet been observed clinically.

2d. Abolition of the direct light reflex in the eye of the same side, and abolition of the consensual reaction in the eye of the other side, if we accept a non-decussation of the pupillary fibers (amaurotic light immobility).

(B) A lesion between corpus quadrigeminum anterius and the photomotor nucleus leads to abolition of the direct as well as consensual light reflex in the eye of the same side, whether we accept a non-decussation or partial decussation of the pupillary fibers in the chiasm. This phenomenon has been observed several times clinically, and represents in cases of lesion on one side, the unilateral Argyll-Robertson phenomenon. As the Argyll-Robertson phenomenon or immobility

to the light reflex is generally found bilaterally, we have to look for the crossing of the pupillary fibers in the mesencephalon, not in the neighborhood of the corpora quadrigemina but in the neighborhood of the photomotor center below the aqueductus Silvii, where a lesion of small dimension can interrupt the communication of the afferent pupillo-motor path on both sides with the photomotor centers of both sides. A lesion in the point marked C in the sketch of the central crossings must lead to a suppression of the consensual reaction in both eyes. We would then find patients who had direct light reaction in both eyes but no consensual reaction. As far as I know, there exists only one observation of this kind in literature, namely, that of Baumeister (*Archiv f. Ophthalmologie*, xix.); he saw a man who showed direct light reaction in both eyes whilst the consensual reaction could not be detected in either.

Based on the above description we have as chain of the neurons of the afferent pupillo-motor path:

1. Cones and rods.
2. Multi-stratified bipolar cells.
3. Multi-stratified ganglion cells.

} RETINA

whose fibers are found as thick ones in:

Optic nerve,
Chiasm,
Optic tract,
Brachium conjunctivum.

4. Ganglion cells of the deeper layers of the corpus quadrigeminum anterius whose fibers form the fasciculus tecto-bulbaris.
5. Ganglion cells of the photomotor center in the oculomotor nucleus.

} MESENCEPHALON.

2d. *Center for pupillo-contraction.*

As the centers are interposed between the arcus sensorio-motoricus as well as between the arcus sensitivo-motoricus, it may be convenient to describe them in part together with the arcus sensorio-motoricus, and in part together with the arcus sensitivo-motoricus.

If we have to consider as the center the point where a centripetal impression changes into a centrifugal reaction, then it is easy to understand that we have to consider as center for pupillo-contraction, or photomotor center, the oculomotor nucleus, by which the excitation received by the retina returns to the periphery (iris).

There are three different opinions about the situation of the photomotoric center:

(*a*) Majano and Van Gehuchten place it, as Flourens did in 1824, in the nucleus lateralis of the corpus quadrigeminum anterius, because it does not give origin to ascendent fibers; this hypothesis has been attacked, especially by Bechterew. We must note here further, the experiments of Gudden, who removed superficial parts of the corpus quadrigeminum anterius, without subsequent changes in the pupillary reaction.

(*b*) Bernheimer places it in the mesial nucleus with small ganglion cells described by Edinger and Westphal, and bases his opinion on the following experiment: In a monkey he excited this nucleus electrically, producing pupillo-contraction; in another monkey, he destroyed this group of ganglion cells and abolished the light reflex; further he found degenerations in this part of the oculomotor nerve after enucleation of the eyeball. These last statements could not be verified by Probst.

Against the first two arguments we have to say that it is almost impossible to excite or to destroy the nucleus of Edinger–Westphal alone, without injuring the neighboring portion. It is too near to the nucleus principalis lateralis. Ramón y Cajal emphasizes the fact that he, as well as many other investigators, could never see that fibers from the ganglion cells of the nucleus Edinger–Westphal join the roots of the oculomotor nerve; he clearly gives expression to his opinion that the nucleus Edinger–Westphal has nothing to do with the oculomotor nerve.

(*c*) v. Monakow believes that the whole gray matter around the third ventricle is responsible, as well as ganglion cells scattered in different parts of the nucleus oculomotorii, and especially the frontal and dorsal pole of the ventral part of the chief lateral nucleus. He is supported in this by Bach and Tsuchida. They base their opinion on the fact that they found intact the nucleus of Edinger–Westphal in cases where

the light reflex was abolished, and that in other cases where this part was completely destroyed, the light reflex was present. The hypothesis of Monakow is strongly supported by the embryological fact that in the fifth fetal month in which the light reflex begins, the chief lateral nucleus alone is developed, and that the nucleus of Edinger–Westphal develops at the earliest in the seventh month. Against the acceptance of the nucleus Edinger–Westphal as the photomotor center, we have further to mention that it is only found in men and monkeys, but not in other animals.

Another important point to which we have to call attention is that the fibers which leave the photomotor center and which must be made responsible for the light reflex—that is, the first step of the efferent pupillo-contraction path, do not undergo any decussation in the pedunculus cerebri. In this regard they differ fundamentally from the fibers which go to the external muscles of the eyes. It is important to decide this point; if further investigations should not show a decussation in this first stage of the efferent path, we are logically forced to accept a semi-decussation of the afferent pupillo-motor fibers in the space between corpus quadrigeminum anterius and nucleus photomotoricus. If this decussation of the afferent pupillo-motor path should not exist, we would not be able to explain the existence of the consensual light reaction. For, as I showed before, the semi-decussation of the chiasm alone does not explain its existence.

3d. *Efferent pupillo-contraction path.*

It was Herbert Majo who called attention (1823) to the fact that pupillo-contraction depends on the integrity of the oculomotorius. By dividing this nerve we can abolish the light reflex; also degeneration of its nucleus produces the same effect. It was Claude Bernard who showed that, notwithstanding the abolition through cutting of the nerve, it was not possible to produce pupillo-contraction by electrical excitation of the nerve in its intracranial path (1860); to produce contraction it was necessary to excite the ganglion ciliare or the nervi ciliares breves. This fact demonstrated to him the importance of this ganglion. Only the fibers for pupillo-contraction and for accommodation enter the ganglion ciliare and find there the connection with the small ganglion cells.

Langley and Anderson showed that after application of nicotine to the ganglion ciliare it was no longer possible to produce pupillo-contraction through electrical excitation of the radix brevis ganglii (1892). Apolant showed (1896) that after having

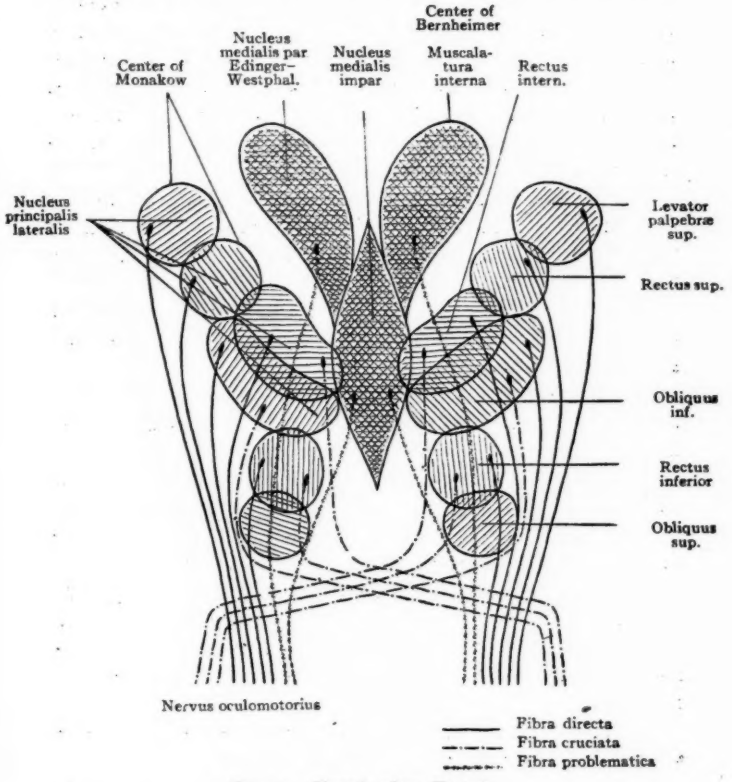


FIG. 7.—Sketch after Testut.

cut the nerve within the skull, the degeneration of the fibers extends only as far as the ganglion, and does not invade the nervi ciliares breves. Angelucci and Lodato showed (1905) that the degeneration, after destruction of the oculomotorius, remains restricted to the small ganglion cells. Langendorff showed that, after having killed a cat, excitation of the nervus

oculomotorius remained without effect on the exterior muscles of the eye, but that it was possible to produce irido-contraction within a certain time after death, by electrical stimulation of the nervi ciliares breves. Frank showed that after having cut the radix brevis, longa, and sympathica of the ganglion ciliare, it was yet possible to produce irido-contraction by stimulation of the sensory nervi ciliares, and that by mechanical compression of the ganglion it was possible to suppress the said pupillary reaction. This shows the importance of the ganglion ciliare and its independence. It is further demonstrated by the following observations:

(*a*) Brown Sequard enucleated the eyes of frogs and exposed them alternately to light and darkness, and thus obtained irido-dilatation and irido-contraction, from 50 to 100 times.

(*b*) Clinical observations show us, in very rare cases, that we can produce irido-contraction through focal illumination in absolutely blind eyes.

(*c*) Hertel (1906) could produce this irido-contraction through systematic experiments on blind eyes, with the help of an electrical arc light (ultra violet rays).

It is uncertain whether these three above-named irritations pass through the ganglion ciliare, or act locally on the muscle cells of the sphincter iridis. It also shows with what precautions we should accept such cases as arguments for the existence of separate pupil and visual fibers. Cutting of the nervi ciliares breves abolishes pupillary contraction.

Excitation of the short ciliary nerves produces rapid contraction of the pupil; excitation of the long ciliary nerves, slow dilatation.

Considering these facts we have the following: ***chain of the neurons in the efferent pupillo-contraction path:***

1. Ganglion cells in the nucleus photomotoricus, whose fibers form part of the nervus oculomotorius.

2. Small ganglion cells in the ganglion ciliare, whose fibers form nervuli ciliares breves.

3. Muscle cells of the musculus sphincter iridis.

B. Sensory motor arc.

1. Sensory afferent path.

It is obvious that this part is responsible for pupillo-dilata-

tion. The excitations come from all sensory nerves of the entire body—from the spinal nerves as well as from the cranial. But of special importance are:

1st. The spinal nerves of the last cervical and of the first three thoracic segments; that is, skin of the neck, of the shoulders, of the arms, and of the breast.

2d. Nervus trigeminus; skin of the face.

The section of the trigeminus produces an insensibility of the iris and a slight contraction of the pupil, which develops slowly and lasts half an hour (suppression of the inhibitive influence of the trigeminus through fibra ascendens fasciculi longitud. post.). This contraction becomes permanent through section of the nervus ophthalmicus (cutting of the sympathetic fibers for the long ciliary nerve). Electrical excitation of the peripherical part of the ophthalmic (Caillaud, 1907) produces a yet stronger contraction of the pupil. Irritation of the sympathetic long ciliary fibers. This shows that we have another sensory reflex arc through the ganglion Gasserii. Enucleation of the eyeball in monkeys is followed by degeneration of a certain number of ganglion cells in the ganglion Gasserii (Marina).

2. Center for pupillo-dilatation.

It is not certain that there really exists a center for pupillo-dilatation in the mesencephalon. We could expect it from the fact that lowering the illumination produces dilatation of the pupil. It is probable that there does not exist an anatomical well-circumscribed part of the brain for such a center, but that this dilatation center is a physiological or hypothetical one and that we understand by it, all the inhibitions which come from the periphery and from the cortex and which influence the photomotor center for pupillo-contraction. The inhibitive influence of the cortex is shown by the fact that we find a small pupil in all cases where these cortical inhibitions are eliminated: in the newly born child, where the cortex is not yet developed, in old people where the cortex is atrophied, in sleep, and in slight narcosis where the excitations coming from the periphery are not elaborated in the cortex, and also as a consequence of morphine, by its narcotic action on the cortex, and finally, in syncope. On the other hand, we observe the influence of the cortex in the very large pupil, upon awaken-

ing, or in darkness where the cortical stimuli get the upper hand over the light excitations.

Bechterew called attention to the fact that pain sensation not only produces pupillo-dilatation, through excitation of the centrum cilio-spinale, but also by inhibition of the center for pupillo-contraction. This inhibition of the photomotor pupillo-contraction center was demonstrated by Braunstein, who showed that excitation of the sciatic nerve was followed by pupillo-dilatation even after complete section of the cervical sympathetic. Even after cutting the trigeminus, the ganglion cervicale superius, and the cervical cord, frightening the animal produced irido-dilatation. This experiment can be explained only through a pure cortical inhibition. But there also exists a pure reflex dilatation without any influence of the cortex, as shown by the experiments of Trendelenburg, who produced pupillo-dilatation after extirpation of both hemispheres.

We know very little of the connection of the afferent sensorio-pupillo-motor pathway, with its efferent pupillo-contraction path. We know almost nothing about the connection of the sensorial as well as the sensory afferent pupillo-motor pathway with its efferent pupillo-dilatation path. Pupillo-contraction is executed through the para-sympathetic vegetative nerve of the mesencephalon—*i.e.*, the nervus oculo-motorius; pupillo-dilatation is produced by the sympathicus, and it is natural to conclude that the origin of the pupillo-dilatation path is the sympathetic vegetative nerve of the mesencephalon which runs down from the corpora quadrigemina through bulbus and medulla to the cervical cord. It is a very surprising fact, that excitation of the opticus produces pupillo-contraction, while excitation of all other sensory nerves, cranial as well as spinal, is followed by pupillo-dilatation. For the connection of these different sensory nerves with the photomotor contraction center, or its afferent sensory path, we have to consider the fasciculus longitudinalis posterior. This fasciculus longitudinalis posterior goes down from the mesencephalon to the spinal cord. The fasciculus longitudinalis is situated so near to that of the other side that they come in contact in some places. The fasciculus is composed of:

(*a*) Fibræ ascendentes.

These are direct fibers which conduct the excitation from the ganglion cells of the posterior horns, through the tractus

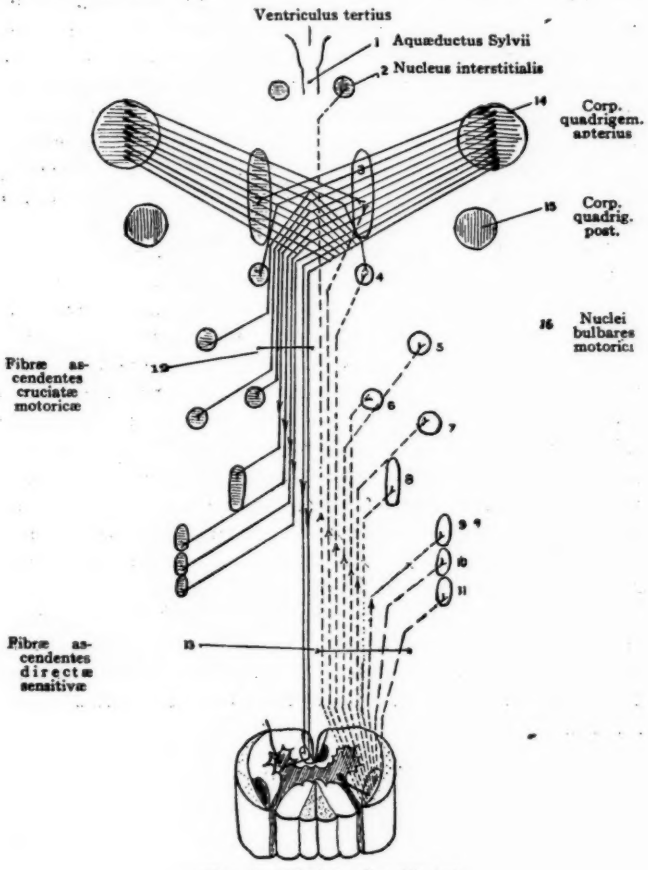


FIG. 8.—Sketch after Testut.

antero-lateralis to the motor nuclei of the cranial nerves. The homologous part of the trigeminus has been described by Mahaim as fasciculus latero-dorsalis, which goes from the termination of the trigeminus, *i.e.* from the superior part of

the columna gelatinosa, through the formatio reticularis in the fasciculus longitudinalis posterior.

(*b*) Fibræ descendentes.

These are the axis-cylinders of the ganglion cells of the corpora quadrigemina anteriora (according to Held) and the fibers of the ganglion cells of the nucleus interstitialis (according to Cajal); they conduct the excitation from the mesencephalic centers to the motor nuclei of the cranial nerves as well as to the anterior horns of the cervical spinal cord. It is well to bear in mind that in the dilatation of the pupil after lowering the illumination, we have two reflexes—a direct one, and a consensual one.

This may be illustrated by a sketch after Testut.

There doubtless exists an anatomical center for pupillo-dilatation in the cervical spinal cord. Attention was first called to it by Parfour du Petit (1727), who showed that section of the cervical sympathetic was followed by contraction of the pupil on the same side. Budge (1851–1855) was the first to give us precise knowledge regarding this center, which he called centrum cilio-spinale, by means of the following experiment: He found that if the spinal cord between the sixth cervical and the fourth thoracic segment was isolated by transverse sections above and below, stimulations of this area caused dilatation of both pupils, which disappeared on one side if the corresponding sympathetic was cut. Stimulation of the cord above or below this region caused no effect. Jacobsen localized this centrum cilio-spinale through anatomical examinations in a case of tumor in the ganglion cells at the apex of the lateral horns of the last cervical and first thoracic spinal nerve.

(*To be concluded.*)

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ABSTRACTED BY DR. M. URIBE-TRONCOSO, NEW YORK.

HOMAGE TO DR. P. LAGLEYZE. The first article of the book is a report of a special meeting of the Buenos Aires Ophthalmological Society in which Drs. Demaria and Arganaraz paid tribute to the memory of Prof. Lagleyze, considering him as the founder of modern ophthalmology in Argentina. He was Professor of Ophthalmology since 1889, and at the time of his death, which occurred in August, 1916, he had seen more than 200,000 patients with eye diseases in his clinic. Professor Lagleyze was a very accomplished surgeon and originated many operative methods, the principal ones being his operation for entropion, now used extensively in Egypt for trachoma, and his tucking operation of the eye muscles for strabismus.

His contributions to ophthalmology were very large. Many years before Von Hippel he described the aneurismatic degeneration of the retinal arteries. His work on albinism and a very valuable book on strabismus published in french are well known. Professor Lagleyze was the founder of the Buenos Aires Ophthalmological Society, now in its fourth year of existence.

DR. J. A. CABAUT. TWO CASES OF FILARIA LOA.

Report of two cases of this rare disease, in the first of which the author was able to remove the parasite, which was moving freely under the skin of the inferior lid, by means of a threaded needle passed through the skin around the vermes and tied quickly, in order to capture it. A small incision in the skin

allowed a forceps to catch and pull the parasite, which came out intact. It was six centimeters long by half a millimeter wide. Under the microscope it proved to be a *Filaria Loa*.

Another parasite was removed some days afterward from under the conjunctiva of the same eye. As it moved very quickly, Cabaut was only able to catch it with a forceps through the conjunctiva. In making the incision the vermes was cut in two parts and only the caudal end extracted.

Examination of the blood of this patient during daytime showed great quantities of embryos surrounded by a sheath. Marked eosinophilia.

In the second patient the parasite was also seen under the conjunctiva and the same method of extraction employed with partial success, due to the swiftness of the vermes.

Only six other cases are reported in the ophthalmological literature of Argentina; all in patients that, as those of Cabaut, have lived in Congo, Soudan, or other places in Africa, where it is very common.

Dr. E. B. Demaria. Hydatid Cyst into the Eyeball.

Echinococcus is very common in Argentina, but an endocular localization of this parasite had never been described. Demaria has been unable to find it in many hundred of enucleated eyes, sectioned at the clinic. This is the most surprising: 1st, because it is very common in all other parts of the body, even in the orbit (twenty cases reported in Argentina), and 2d, by comparison with the cysticercus, which has so marked a tendency to grow into the eye, so great indeed, that some writers have considered it as its habitual place of living.

In the whole ophthalmic literature there are only four cases reported of intraocular hydatid cysts, and of these only one is reliable. In fact both tenias, the solium and the echinococcus, live and migrate in the same manner in the body.

Dr. Demaria's patient presented slight pericorneal injection, iris completely applied to the posterior part of the cornea, lens cataractous, tension + 2; no light perception, projection lost. An intraocular tumor with secondary glaucoma was diagnosed, and a trephining operation done, which relieved tension for a few days; but a new attack of pain having set in the eye was enucleated.

Section of the globe gave way to a transparent liquid as

clear as "water from a rock" and a cyst was discovered, filling entirely the vitreous cavity and adhering to the retina and lens. The cystic membrane was characteristic. No daughter vesicles were present, but several proligerous vesicles, adherent to the wall and containing scolex, could be observed. An important characteristic feature was the absence of a pericystic membrane and of leucocytic infiltration, which the author attributes to the lack of inflammation of the tissues. The membrane is only a defensive reaction of nature against the parasite, and it seems that in this case the cyst acted only in a mechanical way during all its growth.

This lack of inflammation makes a most important difference with the cysticercus, which always produces a great irritation on the tissues of the eye: intense cyclitis, disorganization, and even sympathetic ophthalmia.

The author reviews afterwards in detail, the five cases reported in the literature (Gescheidt, Griffith, Werner, Wood, and Scholtz) and considers reliable only that of Werner.

The modern methods of sero-diagnosis (Appathie and Lorenz in Argentina, Guedini in Europe) have a great diagnostic value in echinococcus disease. It was positive in Demaria's case and is reliable and constant. Eosinophilia is to be found in about 67% of the patients and is not pathognomonic.

DR. E. B. DEMARIA. TWO CASES OF IRIDO-CYCLO-CHOROIDITIS, GRAVE AND BILATERAL, IN PATIENTS AFFECTED WITH VITILIGO.

In the first case, a young man 18 years old, the coincidence in the march of the ocular condition and the vitiligo was so regular that it could have been easy to correlate both conditions. In the second, a woman 45 years old, the uveal inflammation started six years after the beginning of the vitiligo, and was very severe; moreover a general examination did not show other pathological condition to which the ocular changes could be referred; still in the first case a tuberculin injection gave a strong positive general and local reaction, and in the second case Wassermann was positive. Demaria thinks that the vitiligo had nothing to do with the eye trouble, was a mere coincidence, and that the result of the tuberculin and Wassermann show the true nature of the disease. He even

doubts if in the cases reported by Gilbert in 1910 and Erdmann and Komoto in 1911, there was observed a true relationship between the vitiligo and the optic neuritis, uveitis, and choroiditis, or if they were of other origin; because (except in the case of Erdmann) diagnostic tuberculin injections were not made. New clinical observations are therefore necessary to settle this point.

Demaria, however, thinks that a close relation exists between certain inflammations of the uveal tract and the condition of the pigment. He recalls the well-known heterochromia iridis of Fuchs, in which the lighter colored eye develops uveitis later in life, and the new theories on the causation of sympathetic ophthalmitis: the cyclo-toxin of Golowin and the anaphylactic theory of Elschnig.

DRS. DEMARIA AND CALDORA. ASSOCIATED MOVEMENTS OF THE SUPERIOR LID AND THE MASTICATION.

History of a case of this rare anomaly in which during rest a slight ptosis existed of the right eye, disappearing and even leaving exposed a part of the sclera above the cornea when the inferior maxilla was drawn downward in mastication. The elevation of the upper lid attained its maximum when the jaw was moved laterally in the opposite direction of the affected eye. The other ocular muscles were normal, except the pupil, which was larger than that of the other eye, although its reactions to light, accommodation, etc., were not impaired. The presence of this anisocoria is the principal interest of the case.

The anomaly is stationary. Sixty-eight cases have been reported to date, the first being that of Marcus Gunn in 1883. All these observations can be divided in three groups. In the first the elevation of the lid is produced when the mouth is opened and the jaw displaced laterally. In the second (less numerous) the levator palpebræ contracts only in opening the mouth, and in the third group only when the jaw is moved laterally.

The most general opinion of the cause of this condition is that the nucleus of the oculomotor is congenitally in relation with the trigeminus and even with the facial, the movements of mastication being principally commanded by the mesencephalic center which is near the origin of the oculomotor.

Lutz, however, opposes this view and holds that the disorder must be located in the subcortical centers. On the ground of the anisocoria observed in their case, the authors claim that the trouble must reside in the cortical centers, near the foot of the frontal convolutions, which are probably connected with each other by Meynert's U fibers.

DR. FERNANDEZ DE CASTRO. PARINAUD'S CONJUNCTIVITIS, TUBERCULOSIS OF THE CONJUNCTIVA.

History of a case of Parinaud's conjunctivitis with red and yellow granulations and ulcers in both lids, accompanied by swelling of the parotid and preauricular glands. The smear of the discharge and the inoculation of a piece of conjunctiva into the cellular tissue of the abdomen of a guinea-pig proved negative. Pus from the preauricular gland was sterile. However, histological examination of a piece of conjunctiva near one ulcer showed zones of necrosis and cells of Langhans, indicative of tubercular infection. Von Pirquet reaction was strongly positive.

A new inoculation of conjunctiva under the skin in a guinea-pig produced caseous glands in the groin.

The author considers his case as of undoubted tubercular origin.

DR. P. B. FERRO. CONTAGIOUS CONJUNCTIVITIS IN ARGENTINA AND ITS PROPHYLAXIS.

The author lays stress on the greater proportion of contagious conjunctivitis in Buenos Aires, which has increased from 9% in 1891 to 25% in 1917. This increase is especially due to a greater number of cases of trachoma, that has become prevalent all over the country. Altitude has no influence in its extension, as Chibret asserted. The increase is due to immigration of trachomatous patients, and the author insists on the necessity of the exclusion of these immigrants from Argentina, and the control by the Federal Government of all matters related to public health.

DR. R. GIL. PNEUMOCOCCUS CONJUNCTIVITIS.

Gil has examined bacteriologically in the clinic of Professor Demaria sixteen cases of acute catarrhal conjunctivitis of which nine (56%) were produced by the pneumoccocus. This high percentage is in contrast with the statistics of European authors, who have found from 5% to 10% of pneumococcus

conjunctivitis, but agree with Gifford's figures in the United States.

DR. A. GOWLAND. VOLUNTARY NYSTAGMUS.

Before reporting his case, the author reviews all we know about nystagmus, its divisions, symptoms, and etiology. The involuntary or ordinary nystagmus is defined, according to Sauvineau, "a convulsive phenomenon related to an irritative lesion of the center commanding the associated lateral movements.

Voluntary nystagmus is very rare and the cases reported in literature are very scarce. Dr. Gowland's patient was a man, 36 years old, in good health who only wanted to have glasses fitted. He attributed the diminution of his vision to a "voluntary twitching" of his eyes. He was able to produce at will a horizontal nystagmus, which persisted in every direction in which the eyes were moved. Pupillary reaction normal; no hippus, no anisocoria; fundus normal. Refraction: simple hypermetropic astigmatism of one diopter. During the oscillations all objects were seen moving. A strong concentration of will power upon the eyes was necessary to produce the condition. This voluntary twitching existed since childhood and was a source of merriment for him during his school days.

The father is dead; mother and two brothers living and in good health.

Voluntary nystagmus has been divided into three groups: rhythmic physiologic, true voluntary nystagmus, and the associated or Straunsky's, and the reflex or Bar's. Affergeld, who studied the first type, showed that it occurs with the lateral movements of the eyes, when rhythmic horizontal or rotatory, symmetrical oscillations of the globe supervene, especially marked on the side to which the eyes are rotated. It is observed in subjects without any disease of the eyes, ears, or nervous system, and is probably the result of the muscular strain in forced lateral movements. The extreme conjugate deviation of the eyes probably produces a stimulation similar to that provoked by vestibular stimulus, and extends to the rhythmic centers.

True voluntary nystagmus appears, according to Raehlmann, only in patients with marked visual anomalies which have existed from childhood, but Coppez's cases, and also the

one above described by Gowland, show that visual anomalies are not necessarily present. Nystagmography showed that contractions are irregular, without definite character, of variable duration, and changing from one twitch to the other.

Wecker has described a case associated with contraction of the pupil, and Coppez another with hippus. In this case the oscillations disappeared during the lateral movements.

The pathogeny of this rare condition, according to Coppez, must be ascribed to the following causes. In normal conditions the will acts only upon one center of association for moving the eyes in a lateral direction, but in nystagmus the voluntary stimulus goes to the centers on both sides, and if some kind of heterophoria is present the deviation at once appears. The position of the globes being modified and the ocular muscles subjected to an exaggerated tonus, react as usual by contraction, and nystagmus results.

The retraction of the lids during the twitching, proves that the levator palpebræ also receives an exaggerated stimulus.

Associated nystagmus, described by Straunsky in 1900, is a variety of voluntary nystagmus, due to the defensive reaction of the organism and produced in an indirect way. It occurs in patients suffering from palpebral and corneal lesions, or those with photophobia, when an attempt to open the lids is made. It has been observed also in perfectly normal subjects.

Bar described cases of conjunctivitis in which traction of the lid produced oscillations in the globes of an undulatory type, probably due to a reflex movement by stimulation of the trigeminus. This may be caused also by a foreign body, a corneal ulceration, or simply by any loss of epithelium of the cornea. The stimulus is transmitted to the bulbar nucleus of the trigeminus, and by the posterior longitudinal fasciculus to the nucleus of the oculomotor and its association centers.

Dr. Santos Fernandez (Cuba). Paralysis of the Seventh Nerve.

The author reports 70 cases of paralysis of the facial nerve observed among 50,000 patients in his practice, or about 0.11%, as compared with 0.76% for the paralysis of the other motor nerves. In these 70 cases the most important symptom

was: the mouth deviation in 44; the facial asymmetry in 15; lacrimation in 47; and lagophthalmos in 46; of the last 2 in leprous patients.

The etiology was: "taking cold" in 52 cases; syphilis in 3; injury in 7; congenital in 3; with hemiplegia in 5.

Dr. Santos Fernandez (Cuba). Re-Establishment of the Transparency in Opaque Corneas.

Ibid. The Operation of Congenital and Traumatic Soft Cataracts.

Dr. Otto Wernicke (Buenos Aires). Total Achromatopsia.

Although partial blindness for colors is of common occurrence, total achromatopsia is very rare. The number of cases reported has increased recently, since we have learned to suspect the condition by other and more noticeable symptoms than the color tests.

Achromatopes learn to distinguish colors, and even to name them, by their respective difference in brightness, by the presence or absence of reflexes on the surface, by the form of the objects, and by habit. But for them the world is only an engraving with shades of gray and white.

They generally go to the oculist to be relieved of three important symptoms, viz.: low visual acuity, photophobia, and nystagmus.

Visual acuity generally varies from 1/10 to 1/5; rarely reaches 1/3. Only one case is reported in the literature (Raehlmann) in which acuity of vision was normal.

Low vision is due in some cases to corneal scars, atrophy of the optic nerve, macular choroiditis, albinism, etc., but in the majority of cases there is no organic lesion which may account for it. The amblyopia is almost constant and not a mere coincidence, as has been suggested. This may give some clue for ascertaining the cause of the anomaly.

Photophobia is correlated to the third symptom: the nystagmus. When the former is severe the latter is very marked, and *vice versa*. Photophobia is a most striking symptom: the forehead is wrinkled, eyebrows contracted, palpebral aperture very narrow, head flexed. Dread of light increases with the intensity of illumination and decreases at night.

Luminous sense is normal in achromatopes. The nystagmus is rarely wanting, but it is not as constant as the amblyopia. Moreover in some cases it ceases with advancing age. It generally increases on fixation and is probably due to another very important symptom: central scotoma.

Roening was the first to detect central scotoma, which has been found afterwards in nearly half of the patients; but it is necessary to have always in mind that its detection is very difficult or sometimes impossible. Uhthoff, who in one of his patients did not find it at first, was able to plot it a year later with a new method: the ring-shaped fixation test.

According to Grunert, even in cases in which central scotomata could not be detected, an anomaly of the macula or of the macular fibers certainly existed. This is the only way to explain how with very low central vision the limits of the visual field and peripheral vision in general were normal.

Achromatopes see red and the adjoining colors in the spectrum as a dark spot, and violet and near-by colors brighter than the normal eye. Red is mistaken for black. Yellow green is the brightest. The limits of the spectrum are either the same as normal or a shortening of the red end or of both ends may be present.

The best method for detecting achromatopsia is Holmgren's test. Hering disk and the spectroscope are also useful.

Dr. Wernicke's cases were two brothers, 18 and 12 years of age, born in a family of seven. No history of consanguinity. Daylight was troublesome and provoked continual blinking. If the elder brother kept his eyes open in strong light, after a few moments all appeared white to him. Vision improves at dusk. He is scarcely able to read and his school work was so deficient that he went to work in a hat store from which he was discharged because of his inability to distinguish colors.

Pupils react well to light and in accommodation. Fundus normal. Hyperopic astigmatism of half a diopter. Correction did not improve vision, which is only 1/10 for R. E. and 2/10 for L.E. Nystagmus is present and consists of small, very rapid, vertical movements, which do not increase on fixation. Red is mistaken for black and colors selected according to their brightness.

In the younger brother the symptoms were alike. Vision: R. E. 1/10, L. E. 1/10.

Clinical findings in cases of achromatopsia have exerted the greatest influence on the theories of color vision. Both Young-Helmholtz and Hering's theories needed to be modified in order to explain this condition. The first theory was modified by Parinaud and Charpentier and holds that the function of the cones is restricted to color sensations (black and white included), and that the function of the rods is the perception of light and dark and also black and white. These two systems do not work simultaneously. When the light is strong the cones transmit the sensations of all colors to the brain, but when illumination decreases, the cones cease to become stimulated, and then the rods begin to perceive sensations by the destruction of the visual purple. As the regeneration of this substance is very slow, peripheral vision is always bad in normal eyes, particularly in low illumination, for which the cones are not adapted. Hence the achromatopsia of the normal eye in darkness.

Total achromatopsia is due to lack of cones in the macula. This produces also the central scotomata and accounts for the poor vision of these patients and the nystagmus.

Hering's theory also is capable of explaining achromatopsia if modified to admit the duplicity of the function for the rods and cones as suggested by Parinaud and Charpentier.

It will explain perhaps more easily the case of Raehlmann in which achromatopsia was attended with normal vision and photophobia and nystagmus were absent.

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By LEWIS W. CRIGLER, M.D., Secretary.

GEORGE H. BELL, M.D., CHAIRMAN. MONDAY EVENING, DECEMBER 17, 1917.

Dr. Isaac M. Heller showed a case of **excessive secretion of the Meibomian glands.**

Dr. Heller also presented a case of **xanthelasma that had been treated by fulguration with marked improvement.** He confined his treatment to one side only in order to study the effect of the treatment as compared with the non-treated side. The results were very apparent. The treatment was associated with moderate pain but there was no reaction or pain following the treatment.

Dr. James G. Dwyer read the paper of the evening: **Focal infections in the eye with special reference to the intestinal tract, with report of cases** (published in full in this number of the Archives).

Discussion: Dr. John E. Weeks said that it was a fact widely known that toxines absorbed from the intestinal tract were responsible for a large percentage of eye disturbances and that he hoped that this line of attack would lead to more definite results.

Dr. E. S. Thomson said that he had been interested in the relation between disturbances of the digestive tract and diseases of the eye for a long time. He said that heretofore eye troubles which he had traced to the intestinal tract as their underlying cause, would improve when treatment was directed to this cause, but recurrence was frequent. Dr. Thomson said that he was glad of the opportunity to test out the method

suggested by Dr. Dwyer. He said that he had had something over twenty cases under observation and treatment. Several cases of low-grade inflammation simulating glaucoma cleared up under the treatment. One case, in a woman 56 years of age, of iridocyclitis with light perception only, began to clear up in four or five days and recovery was more rapid than anticipated. One case with a corneal ulcer from fever, mucous colitis, and anemia got well in two weeks under the treatment. There were several cases of scleritis which seemed to improve as the intestinal condition improved; when the intestinal condition became bad again the scleritis would return.

Dr. L. A. COFFIN said that he had been interested in the relationship between the gastro-intestinal disturbances and focal infections ever since he began the practice of medicine, and that the longer he practiced the more he realized the preponderance of troubles springing from failure to correct the underlying cause—disturbed function and disease of the intestinal tract. The case to which Dr. Dwyer has asked him to refer was briefly as follows: A young married woman complained that she saw everything double. I took her immediately to an oculist, who gave her careful examination and told me which muscles were paralyzed. I asked, "What are the indications?" He replied, "bichloride of mercury." Again I asked, "What are the insinuations?" He replied that he thought I knew, to which I replied that I knew this lady's father, mother, husband, and son, and that I did not believe it. I then took the lady to the laboratory for a Wassermann blood test, the report being negative. The oculist told me that had the spinal fluid been examined, the report might have been different. The spinal fluid was examined by Dr. Dwyer. It too was negative. The lady was then put on generous doses of castor oil, intestinal irrigation, etc., and after about ten days' treatment, was entirely relieved of her diplopia from which she has not since suffered—now about two years.

Dr. B. W. KEY said that any focus of infection no matter where located is apt to excite a serous inflammation, and even destruction of delicately sensitive and actively functionating structures, such as the uvea and retina. He thinks Dr. Dwyer's studies and clinical reports a valuable contribution

to the already extensive investigation on the subject. In one case he had followed out Dr. Dwyer's line of treatment where it was found that the colon bacillus had almost entirely disappeared from the feces; there was one apical-tooth abscess however. The patient made a complete recovery without any further attack up to the present time. Dr. Key is unable to say whether or not the patient might have recovered under ordinary eliminative treatment with regulation of the bowels.

Dr. GEORGE H. BELL said that we should bear in mind that the gastric juice is not only a secretion but an excretion as well; that any thing that goes into the stomach which tends to produce more gastric juice than normal, tends to produce acid stools. He referred to the excessive use of cane sugar which breaks up in the stomach after fermentation into acids (two) and alcohols. He said that it was obvious in such cases that sugar should be eliminated from the diet.

BY HENRY H. TYSON, M.D., SECRETARY PRO TEM.

MARTIN COHEN, M.D., CHAIRMAN. MONDAY EVENING, JANUARY 21, 1918.

Reading of the minutes of the meeting of December 17, 1917, by the Secretary *pro tem*. On motion, were approved as read.

Dr. JOHN E. WEEKS presented a case of **congenital coloboma of the macular region in both eyes** in a boy aged 5½ years. The colobomata were irregularly circular, having a diameter of about two millimeters in the right and three millimeters in the left eye. Vision R. 20/50, L. 1/200. The colobomata appear to affect the retina and inner layers of the choroid only. The retinal pigment was plentiful at the margins and there were a few small patches of retinal pigment scattered over the floor of the defects. The layer of large vessels in the choroid and the pigmented stroma of the choroid were intact. Retinal blood-vessels passed over a portion of the defect in each eye. The colobomata apparently have no relation to defects consequent on the imperfect closure of the retinal fissure, but are due to defects in the development of the choriocapillaris at the maculæ,—an explanation first advanced by Collins and Mayou.

Dr. ALFRED WIENER presented a case of **complete bilateral**

ophthalmoplegia in a man aged 67 years, following an attack of influenza. There was no loss of consciousness, and none of the other cranial nerves were involved. After six weeks there has been a gradual return of power in all of the muscles of both eyes, so that at the present time both eyes are practically normal. In view of the fact that this occurred in a patient with rather marked arteriosclerosis and came on suddenly, Dr. Wiener considers the ophthalmoplegia to be due to a thrombosis at the upper end of the basilar artery. He believes that one other explanation might account for this paralysis. A toxic agent circulating in the blood has been considered by some authors as a possible cause for abolishing function without visible changes. Such an opinion might be considered, but it hardly seems plausible.

DISCUSSION: Dr. LESZYNSKY thought that the possibility of polioencephalitis superior should be considered as a possible cause in this case.

Dr. WEEKS related a similar case examined by him about twelve years ago, coming on twelve days after the inception of grippe.

Dr. BLAKE referred to a case following influenza, which he thought was due to basilar meningitis.

Dr. ARNOLD KNAPP read a paper: **Return of tension after trephining, with a report of two cases.** The paper is published in full in this number of the ARCHIVES.

DISCUSSION: Dr. WILMER related a case in which at first an apparently perfect result was obtained, but later on account of return of tension, three separate trephinings and iridectomies were performed. Tension, previous to operations, between 30 and 40, reduced by trephining to about 14 would later rise to former high tension. Site of trephining would fill up with proliferated tissue. Case had tubercular history.

Dr. WEEKS stated that he also had had cases in which intraocular hemorrhages had occurred and trephining openings had been closed by iris, ciliary processes, and proliferated tissue. He has abandoned trephining except in very chronic glaucomas, buphthalmos, and like conditions. He also has had late infection. He thinks the operation is complicated by many possible mishaps, and he is now performing the LaGrange operation instead.

Dr. DENIG uses trephining in chronic simple glaucoma only.

Dr. GIFFORD considered trephining most suitable for chronic simple glaucoma and thinks it may be tried where tension is very high. He instructs the patient to use zinc collyrium daily during the rest of their lives in order to prevent late infection, and to pay particular attention to their conjunctival sacs. In buphthalmos his first two operations were unsuccessful on account of closure of trephine opening.

Dr. KNAPP asked Dr. WILMER for the cause of the proliferating process in his case. Dr. Wilmer thought that the tubercular lesion was the indirect cause.

Dr. RUDOLPH DENIG read a paper on **Transplantation of the mucous membrane of the mouth for various diseases and burns of the cornea, with a report of one hundred and fifty cases.** The first case was operated on by him in October, 1910. The results are most gratifying. Trachomatous and scrofulous pannus, herpes and allied processes of the cornea, lime and ammonia burns and burns caused by the contents of a golfball yielded quickly to transplantation.

DISCUSSION: Dr. WOOTTON was of the opinion that in some trachoma cases the Heisrath operation if performed properly gave good results, but that transplantation was a valuable addition as a last resort in old trachoma cases.

Dr. GIFFORD uses a Thiersch graft of mucous membrane from the lip which he obtains with a razor. He stated that pannus usually disappeared with the trachoma.

Dr. TYSON referred to a case of corneal burn with molten lead, in which he used a transplantation of mucous membrane, about four years ago, which still remains of a deep red color.

Dr. DENIG stated that if the transplanted flaps were too thick they remained red for some years, but eventually turned white.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY FOR THE SECOND, THIRD, AND FOURTH QUARTERS, 1917.

By H. KOELLNER, Berlin; W. KRAUSS, Marburg; R. KÜMMELL, Erlangen; W. LOEHLEIN, Greifswald; H. MEYER, Brandenburg; W. NICOLAI, Berlin; H. PAGENSTECHER, Strassburg; K. WESSELY, Würzburg; and M. WOLFRUM, Leipsic, with the Assistance of Drs. ALLING, New Haven; CALDERARO, Rome; CAUSÉ, Mayence; CURRAN, Kansas City; DANIS, Brussels; GILBERT, Munich; GROENHOLM, Helsingfors; v. POPPEN, Petrograd; TREUTLER, Dresden; and VISSER, Amsterdam.

Edited by MATTHIAS LANCKTON FOSTER, M.D., F.A.C.S., New Rochelle, N. Y.

I.—GENERAL OPHTHALMIC LITERATURE.

1. ADAMS P. H. **The influence of vascular disease of the retina on the prognosis as regards life.** *British Journal of Ophthalmology*, March, 1917.

2. CANTONNET, A. **The usual alphabet for the blind.** *Clinique Ophtalmologique*, vii., 2.

3. CHAPPÉ, TH. **A few opportune operations.** *Annales d'Oculistique*, cliv., 4.

4. CRUISE, R. R. **Protection of the eye in warfare.** *British Journal of Ophthalmology.*

5. DIANOUX. **The abuse of enucleations.** *Clinique Ophtalmologique*, viii., 2.

6. DOR, L. **Late results after enucleation and evisceration.** *Ibid.*, viii., 4.

7. DOR, L. **Eyeglasses and masks.** *Ibid.*, vii., 4.

8. GENET, L. **Hemianopsias of cortical origin; evaluation of their compensation.** *Annales d'Oculistique*, cliii., 4.

9. GENET, L. **The blind of one eye.** *Ibid.*, cliii., 6.

10. ROCHON-DUVIGNEAUD, A. **The ophthalmological reform.** *Ibid.*, cliv., 1.

11. ROURE. **Recuperative ophthalmics.** *Ibid.*, cliii., 4.

12. TEULIÈRES, M. **The evaluation of loss of function in aphakic eyes of soldiers.** *Clinique Ophtalmologique*, viii., 1.

ROCHON-DUVIGNEAUD (10, **Ophthalmological reform**) calls the attention of the profession to a number of reforms absolutely necessary to raise the French ophthalmology to a proper efficiency. He recommends the opening of a special eye hospital for children, a change in the methods of teaching of this subject, mostly for training ophthalmologists, the appointment of whole-time professors, the teaching of ocular physiology and physiological optics, which are not given anywhere in France, and the foundation of special laboratories for these branches of ophthalmology.

SCHOENBERG.

At the Ophthalmological Congress held at Oxford in 1917, Captain ADAMS (1, **The influence of vascular disease of the retina on the prognosis as regards life**) gave an account of an investigation which he had carried out to ascertain the fate of patients who had been found to suffer from vascular disease of the retina. The results of the research are so valuable that every medical man, whether ophthalmic surgeon, physician, or general practitioner, should make a careful study of the paper which expounds them.

The types of retinal lesion under consideration were, flame-shaped hemorrhages, venous embolism, retinitis circinata, and other conditions associated with arteriosclerosis.

Twenty years ago it was taught that persons who exhibited these retinal hemorrhages were liable to die within two years. Every observant physician soon became aware of the falsity of such a gloomy prognosis, and now Captain Adams has shown that under certain circumstances the prospect is really good.

He has collected 159 cases from the records of the Oxford Eye Hospital, and has traced 124 of them.

The critical factor with all these patients was soon seen to lie in the presence or absence of albumin.

Thus:

With albumin.

One died in five years of cerebral hemorrhage.

One died in five years of phthisis.

One died after three years ten months of Bright's disease.

One died in three years five months of nephritis.

One alive after two years three months.

One died in three months of granular kidney.
One died in four months.
One alive after six years.

Without albumin.

One alive after 26 years.
One alive after 25 years.
One alive after 17 years.
One alive after 16 years.
One alive after 11 years.
One alive after 4 years.

In many cases there was no note of the condition of the urine but there was ample evidence to state that when albumin is present the prognosis is bad and that when it is absent it is good.

A consideration of the cases grouped into age periods showed that the older the patient the better the prognosis, and *vice versa*, the younger the worse the prospect.

T. HARRISON BUTLER.

GENET (8, **Hemianopsias of cortical origin, evaluation of their compensation**) thinks that a practical way of determining the amount of compensation due to soldiers with cortical or subcortical injuries of the optic paths is to figure out the amount of loss of the field of vision. A normal eye has a field of vision of 10/10; both eyes 20/10. The loss of one eye is compensated for, by law, by 30% of the amount given for loss of both eyes. If 30% is awarded for a loss of 10/10 of the field vision, 3% ought to be awarded for a loss of 1/10 of field. On this basis it is easy to evaluate even charts showing an irregular outline of loss of field of vision. For instance: (1) A bilateral homonymous hemianopsia is, according to the author, equal to the loss of one eye. Compensation = 30%. (2) Quadrant hemianopsia. If a wounded soldier has lost a quadrant of 3/10 of the field in each eye he is entitled to 6/10 of 30% or 6 x 3 = 18%. (3) If a wounded soldier has lost a portion of the field of vision exceeding 10/10 the compensation has to be figured somewhat differently. The first 10/10 of the lost field gets 30%, the value of the first eye. The remaining eye has a value of 70% (100 − 30); consequently the remaining 10/10 are entitled to 70% compensation, and each 1/10 is to be awarded 7%. A concrete instance will illustrate

the subject. If a wounded man has lost 7/10 of the field in each eye, he is entitled to 30% for the first 10/10 of the lost field and 4 x 7% = 28% for the remaining 4/10 of the lost field. Total 58%. (4) Finally, a hemianopsia in an only remaining eye, the other having been enucleated, is to be compensated for in the same manner, as figured above. The first eye lost is compensated for by 30%. The 5/10 of the lost field of the second eye has to be awarded 5/10 of 70%, that is 5 x 7 = 35%.

SCHOENBERG.

TEULIÈRES (12, **The evaluation of loss of function in aphakic eyes of soldiers**) estimates the partial loss of function and vision in aphakics higher than the partial loss of vision in non-aphakics. The aphakic eye, having lost two very important functions (binocular vision and accommodation), is entitled to more compensation than the non-aphakic eye with the same acuity of vision. He would award 5% for the loss of each of these functions. For cases of traumatic cataract of one eye in which both eyes, with correction, have useful vision, he would add 10% to the amount provided by law, as compensation for the loss of vision. Cases in which the non-aphakic eye had been blind or almost blind before the operation are entitled to less compensation, 5% above the indemnity provided by law, because they had no binocular vision before the injury. Cases in which both eyes have been operated on for traumatic cataract, with vision in only one, are, according to the author, entitled to 5% above the indemnity prescribed for the same reason as in the preceding cases. Finally those who have both eyes aphakic but with good vision in both are to be compensated by 15% added to the indemnity prescribed by law on account of their loss of both functions, accommodation, and binocular vision. SCHOENBERG.

GENET (9, **The blind of one eye; statistics**) found that the proportion of one-eyed people, before the war broke out, was 0.81 per thousand. This fact he says should serve as a means of comparison for the future statistics of one-eyed individuals after the war. His material is composed only of men between 23 and 42 years of age who have had one eye partially or totally enucleated. SCHOENBERG.

CANTONNET (2, **The usual alphabet for the blind**) says that

the only writing taught to the blind is the Braille alphabet, which takes a long time to be properly mastered. A large number of blind peasants and laborers never can learn this system of writing. The letters and figures of the author's new system consist of dots, in relief, arranged in such a manner as to imitate the outline of the ordinary alphabet and arabic ciphers. The advantage of the system is: (1) that it can be learned in from ten minutes to two hours; (2) that it can be read by seeing people as well as by blind ones; (3) the writing and the reading are done from left to the right (while in the Braille system the writing is done from right to the left and the reading from left to right). The Braille system has its own advantages, namely, it is read easier, it occupies less space, it is universally taught, and it gives the possibility of teaching music and stenography. For these reasons the author considers his own method as supplanting the older system. None of these two systems has all the advantages.

SCHOENBERG.

ROURE (11, **Recuperative ophthalmics**) refers to those cases of amblyopia in one eye from lack of use, traumatic cataract, or high astigmatism, which may recover a sufficient amount of vision when compelled to use these eyes. He advises to draft all the men with one such eye into the active army service because they can recover a good deal of vision in the amblyopic eye if their good eye should be destroyed by some war injury.

SCHOENBERG.

CHAPPÉ (3, **A few opportune operations**) says that by operating on soldiers with strabismus, pterygium, and corneal opacities, optical iridectomy in the last, a large number of them are made fit for active service. He advises to regard those who refuse an operation as malingerers who prefer the auxiliary service, and to be treated accordingly.

SCHOENBERG.

CRUISE (4, **Protection of the eye in warfare**) describes his visor of chain-mail which is arranged to hang from the helmet across the face. There can be no doubt that it affords adequate protection to the eyes with the minimum of disturbance of vision. The Reviewer, however, believes that he is correct in saying that it is not popular with the troops.

T. HARRISON BUTLER.

DOR (7, **Eyeglasses and masks**) has been told by the soldiers that they cannot wear eyeglasses under their masks on account of the blurring which results from the rapid condensation of vapor upon the glass. Consequently they have to remove the glasses every time they wear a mask. On account of this fact the author advises the military authorities not to enlist for active service myopes of more than 8 D. who could not find their way without glasses when compelled to wear a mask.

SCHOENBERG.

DIANOUX (5, **The abuse of enucleations**) protests against the readiness with which injured eyes are enucleated, many times without any real indication. He advises the utmost possible conservatism. In extreme cases he prefers evisceration on account of the better stump it offers.

SCHOENBERG.

DOR (6, **Late results after enucleation and evisceration**) has had occasion to examine sixty-three soldiers, twenty-three of whom had had one eye enucleated and forty had had an evisceration of one eye performed. He questioned each as to whether he continued to have any trouble in the remaining eye and obtained the following answers: Forty-one said that they had no trouble whatever; twenty-two complained of lacrimation, photophobia, periorbital pains, and accommodative asthenopia. Of these twenty-two patients twenty-one had had an evisceration performed, and Dor believes that this proves the superiority of enucleation.

SCHOENBERG.

II.—RELATIONS OF OPHTHALMIC TO GENERAL DISEASES AND POISONS.

13. BALLANTYNE, A. J. **Quinine amaurosis with a report of a case.** *British Journal of Ophthalmology*, March, 1917.

14. BOURGUET and RONNEAUX. **Homonymous hemianopsia due to a serous meningitis localized in the right temporal fossa. Trepanation and cure.** *Annales d'Oculistique*, cliii., 7.

15. CALHOUN, F. P. **Antityphoid inoculations and ocular lesions.** *Ophthalmic Record*, November, 1917.

16. CHARLIN, CH. **Syphilitic meningitis with bilateral amaurosis.** *Annales d'Oculistique*, cliii., 11.

17. EVANS, J. J. **Fundus lesions in cases of war nephritis.** *British Journal of Ophthalmology*, August, 1917.

18. GABRIELIDES. **Cysticercus of the brain accompanied by papilloedema.** *Annales d'Oculistique*, cliii., 5.

19. GLOAGEN. **Herpes localized on the lids and cornea following antityphoid vaccination.** *Ibid.*, cliv., 1.

20. GROSSMAN, M. **The selective action of spirochetes.** *Journal of the American Medical Association*, March 31, 1917.

21. LEVY, J. M. *et al.* **Investigations as to the frequency of metastatic eye infections from primary dental foci.** *Ibid.*, July 21, 1917.

22. MACKAY, G. **A case of uveo-parotiditis.** *British Journal of Ophthalmology*, October, 1917.

23. MORAX, V. **Herpes of the mucous membranes and of the cornea following antityphoid vaccination.** *Annales d'Oculistique*, cliii., 5.

24. MORAX, V. **Observation of a case of palpebro-ocular herpes following a prophylactic antityphoid vaccination.** *Ibid.*, cliii., 11.

25. MORAX and DUCAMP. **A case of spontaneous arteriovenous aneurysm due to the rupture of an aneurysmatic internal carotid artery into the cavernous sinus.** *Ibid.*, cliii., 6.

26. VAN SCHEVENSTEEN, A. **Traumatic, incomplete, left homonymous hemianopsia, or quadrant anopsia, with conservation of the macular visual fields, accompanied by pure verbal cecity.** *Ibid.*, cliii., 6.

27. WOOD, CASEY. **Eye signs and symptoms of Mongolian idiocy.** *Ophthalmic Record*, May, 1917.

28. ZENTMAYER, WILLIAM. **The eye and the endocrine organs.** *Journal of the American Medical Association*, July 7, 1917.

EVANS (17, **Fundus lesions in cases of war nephritis**) as the result of his experience as ophthalmic surgeon to the first and second Birmingham War Hospitals tells us that the lesions of the fundus met with in trench nephritis are slight in degree and are liable to be overlooked unless the pupil is dilated before the use of the direct method. He also is particular to state that he does not wish to imply that the lesions found are the result of the disease, they are only conditions of the fundus found in cases diagnosed as trench nephritis. Again no attempt has been made to differentiate types or degrees of nephritis. One hundred patients were examined: 43% had a normal fundus; changes were noted in the fundus in the remaining 57%.

The fundus changes observed involved the retina and the optic nerve in 39 cases, the choroid in 34 cases.

Lesions of the Optic Nerve and the Retina. These were slight in character, in fact in many cases doubtfully pathological. In 22 cases the disk was hyperæmic and slightly œdematous; in 13 there was peripapillary retinal œdema,

some perivascular lining, with tortuosity and fullness of the veins. In only one case was the classical appearance of albuminuric neuroretinitis seen. This man was obviously suffering from chronic Bright's disease. In no other case was any evidence of arteriosclerosis present.

Lesions in the Choroid. The author was surprised to find so many cases showing evidence of choroidal disturbance. Here again doubts could be entertained as to their pathological nature.

The chief varieties seen were disseminated choroiditis, and guttate changes at the macula similar to those seen in older subjects.

The most peculiar lesions noted were patches of slaty discoloration near the macula.

The process in both the retina and the choroid seems to be of a low inflammatory type. They seem to point to a toxic origin. The paper contains photographs of the organism.

T. HARRISON BUTLER.

ZENTMAYER (28, **The eye and the endocrine organs**) gives a complete summary of our present knowledge of the ductless glands, but the essay does not lend itself readily to review.

ALLING.

GABRIELIDES (18, **Cysticercus of the brain accompanied by papillœdema**) reports the observation of a girl of 17 with classical symptoms of a brain tumor and bilateral papillœdema. After trephining the skull subdural cysticerci were found, and the symptoms as well as the papillœdema were greatly relieved.

SCHOENBERG.

WOOD (27, **Eye signs and symptoms of Mongolian idiocy**) has had the opportunity to examine eleven cases of this condition. The ocular signs found are as follows: In two thirds of the cases the palpebral fissure was directed decidedly upward and outward, giving a "Chinese" appearance. Epicanthus was present in a quarter of the cases. Blepharitis and ectropion were also found in many. Convergent strabismus was seen in three and the common error of refraction was Hy. Astig. co. Nystagmus occurred in two instances. Cataract of the punctate variety is the most frequent ocular change. It is undoubtedly present quite early but is difficult to discover in infants as the dots are translucent. Changes in the

vitreous and fundus are not characteristic of the psychosis. The ocular defects are not of the familial type.

ALLING.

MORAX and DUCAMP (25, **A case of spontaneous arteriovenous aneurysm due to the rupture of an aneurysmatic internal carotid artery into the cavernous sinus**) report the following case. The patient, 68 years old, presented at the first examination a right-sided pulsating exophthalmus, continuous murmur heard over the temporal region, and paralysis of the third cranial nerve. He complained of an uninterrupted intracranial bruit. The symptoms appeared spontaneously during defecation three weeks previously. Subcutaneous injections of gelatine and ligature of the internal carotid artery were of no avail. The patient died about five weeks after the operation. A post-mortem examination revealed that an aneurysm had developed in the cavernous portion of the internal carotid. The rupture of the aneurysmatic dilatation into the cavernous sinus gave rise to the symptoms of pulsating exophthalmus. This rupture took place during a sudden increase of blood pressure produced by an effort during defecation. The patient had no symptoms before the aneurysmatic carotid had opened into the cavernous sinus. There are recorded in literature only two cases of aneurysm of the internal carotid in the region of the cavernous sinus, one by Dempsey and another by Coggin. Both had pulsating exophthalmus, and died some time after the ligature of the carotid, but the post mortem revealed no communication of the aneurysm with the sinus. In all of these cases extensive atheromatous changes of the cerebral blood-vessels were present which, according to the authors, explained the failure of the operative intervention.

SCHOENBERG.

GROSSMAN (20, **The selective action of spirochetes**) examined a family in which the father had spastic hemiplegia and pupils which did not react to light and only slightly to accommodation. The mother was also syphilitic. Three out of four children had paralysis of the sphincter pupillæ and ciliary muscle, with no reaction to miotics and some signs of congenital syphilis. Under treatment the father's eye did not improve, but in the case of the children there was partial

recovery. Ophthalmoplegia interna is a rare manifestation in syphilis. The lesion is presumably nuclear and must be due to a strain of spirochete possessing selective property for nerve tissue. This symptom may be the only evidence of congenital syphilis.

ALLING.

MACKAY, G. (22, **A case of uveo-parotiditis**) reports the following case. A girl, aged 30, was found to have slight iritis with complete ophthalmoplegia interna. No mydriatic had been used, and none could be traced. When admitted to hospital she developed bilateral swelling of the preauricular portions of the parotid glands. The highest temperature recorded was 99.4 F. The Wassermann reaction was negative. Tuberculin tests were also negative. No growth was obtained from the blood. There was a leucocytosis. A culture from the conjunctiva showed the presence of staphylococcus albus and citreus.

The glands did not become normal for six weeks. The cycloplegia slowly disappeared. Similar cases have been recorded by Heerfordt in which there was no known history of mumps.

Mackay thinks that the case for mumps as the sole cause of uveo-parotiditis is so far "not proven."

T. HARRISON BUTLER.

LEVY (21, **Investigations as to the frequency of metastatic eye infections from primary dental foci**), by treating the teeth of fifty-seven patients, has cured 14% of various inflammatory lesions of the eye and improved 37% . He is of the opinion that the infection, primarily of dental origin, travels to the eye through the lymph channels and not through the general circulation. He bases this on the fact that in all but one of the favorable cases the dental infection was on the same side as the affected eye.

ALLING.

CHARLIN (16, **Syphilitic meningitis with bilateral amaurosis**) reports about a patient 25 years old, with luetic changes in the nose, leucocytosis in the spinal fluid, and complete amaurosis in both eyes of four days' duration. The blindness was cleared up in the right eye by an intensive antiluetic treatment.

SCHOENBERG.

BOURGUET and RONNEAUX (14, **Homonymous hemianopsia due to a serous meningitis localized in the right temporal fossa**) report the following case. The patient, a prisoner of war, was struck by a shell in the right temporal region, and complained some few weeks later of headaches, loss of hearing, and noise in the right ear. The clarity of vision was normal. The field revealed a left lower quadrant homonymous hemianopsia. The diagnosis made was of serous meningitis, circumscribed in the right temporal fossa, pressing upon the right optic tract between the chiasm and the cuneus. A lesion of the occipital lobe was excluded by the absence of optic hallucinations. A trephining of the skull in the right temporal region was performed and from thirty to forty *cc* of fluid flowed out under pressure as soon as the dura was opened. Following the operation the hemianopsia receded gradually and at the end of about two months it disappeared entirely.

SCHOENBERG.

VAN SCHEVENSTEEN (26, **Traumatic, incomplete, left homonymous hemianopsia or quadrant anopsia, with conservation of the macular visual fields, accompanied by pure verbal cecity**) reports the history of a left-handed soldier, wounded in the right parieto-occipital region, who developed a left lower quadrant hemianopsia and pure word blindness. The four cases of quadrant hemianopsia reported by Marie and Chatelin did not show any aphasic symptoms. The author assumes that the lesion consisted of a destruction of the cerebral substance which extended deeply into the optic radiations and temporal lobe. The injury of the association fibers between the visuo-cortical center and the center of the mental representation of ideas has caused the partial alexia.

SCHOENBERG.

CALHOUN (15, **Antityphoid inoculations and ocular lesions**) has observed a case of acute iritis and one of choroiditis following antityphoid inoculations. One patient acknowledged previous gonorrheal infection and the other showed positive Wassermann. It is likely that the irritation of the injections served to light up a latent process. Similar complications have been observed in the French army.

ALLING.

GLOAGEN (19, **Herpes localized on the lids and cornea following antityphoid vaccination**) has seen three cases of this nature. The herpes appeared after the third injection in the first patient, after the fourth in the second, and after the first injection in the third patient. In each one the vision remained very much impaired on account of the central location of the corneal opacity. SCHOENBERG.

MORAX (23, **Herpes of the mucous membranes and of the cornea following antityphoid vaccination**) reports a case in which the eruption appeared three days after the third injection and receded completely in one month.

SCHOENBERG.

MORAX (24, **Observation of a case of palpebro-ocular herpes following a prophylactic antityphoid vaccination**) reports a second case of the same nature. The patient set up a violent febrile reaction two hours after the third injection, and forty-eight hours later a herpetic eruption appeared on the lids of both eyes and the cornea of the right eye. SCHOENBERG.

BALLANTYNE (13, **Quinine amaurosis with report of a case**) summarises his conclusions as follows:

(1) In quinine poisoning complete loss of vision may be found in association with a normal fundus, and there may be striking recovery of vision in spite of well-marked fundus changes.

(2) In all, or nearly all cases of quinine amaurosis, ophthalmoscopic changes, such as narrowing of the vessels, congestion of the disk, and opacity of the retina, make their appearance sooner or later, but there is no correspondence between the character or severity of these changes and the intensity of the visual defect.

(3) The visual defect cannot therefore be due to these changes, but rather to a condition of the retinal elements invisible with the ophthalmoscope.

(4) This condition may be induced or aggravated in the first place by ischæmia of the retina, but in the main it is caused by the direct toxic action of the drug upon the retinal elements. The ultimate recovery of central vision, with loss of peripheral vision and the failure of acuity in twilight, suggests that quinine has a selective action upon the rods.

T. HARRISON BUTLER.

III.—GENERAL PATHOLOGY AND TREATMENT.

29. SCARLETT. **The differentiation of varieties of diplobacilli by serological reactions.** *Annales d'Oculistique*, cliii., 11.

30. TERRIEN, F. **The X-ray treatment of visual disturbances due to the hypophysis.** *Archives d'ophtalmologie*, xxxv., 5.

SCARLETT (29, **The differentiation of varieties of diplobacilli by serological reactions**) has recently described two new species of diplobacillus which show specific characteristic cultural and staining properties. In this paper he reports a series of experiments which prove that the serum of rabbits, which have been repeatedly inoculated with bacillus duplex non-liquefaciens, contains specific agglutinins for this microorganism but not for the diplobacillus of Morax or of Petit. This fact constitutes one more fundamental point of identification for the type of diplobacillus described by Scarlett.

SCHOENBERG.

According to TERRIEN (30, **The X-ray treatment of visual disturbances due to the hypophysis**), the surgical treatment of tumors of the hypophysis is successful only in exceptional cases. Since it has been established that the epitheliomatous, sarcomatous, and lymphomatous tumors respond very frequently to the X-ray treatment, several authors, Bèclère, Jeaugeas, Gramegna, have recommended and employed with satisfaction the X-ray in tumors of the hypophysis. Terrien publishes the histories of nine cases with tumors of the hypophysis from literature and one from his own practice which have been treated by X-ray, all with benefit. Headaches disappeared, vision improved, and the visual fields became larger. The rapidity with which the symptoms improve is remarkable. In seven cases the headaches ceased after the first treatment; the vision improved from 0 to 1/60–7/10. The results are so much the better the earlier the diagnosis is made and treatment instituted. The advanced condition of loss of visual function is no contraindication for the X-ray treatment. There are parts of the field, completely amaurotic, which recover good vision.

SCHOENBERG.

IV.—REMEDIES AND INSTRUMENTS.

31. Cosse. **Ocular prothesis.** *Annales d'Oculistique*, cliii., 7.
32. Coulomb and Ruppe. **Oculopalpebral prothesis.** *Ibid.*, cliii., 4.
33. Cridland, B. **The tonometer of Schioetz.** *British Journal of Ophthalmology*, June, 1917.
34. Dor, L. **A new universal optometric chart based upon the metric system.** *Clinique Ophtalmologique*, viii., 1.
35. Lloyd, R. L. **The stereoscopic campimeter slate.** *Ophthalmic Record*, August, 1917.
36. Stein, I. F. **The use of sophol in the prevention of ophthalmia neonatorum.** *Annals of Ophthalmology*, July, 1917.
37. Valois. **Remarks on ocular prothesis.** *Annales d'Oculistique*, cliv., 6.
38. Valois, G., and Rouveix. **Prothesis for the one-eyed of the war.** *Ibid.*, cliii., 12.
39. Woods, H. **Some phases of the diagnostic and therapeutic uses of tuberculin in uveitis. Illustrated by four cases.** *Annals of Ophthalmology*, April, 1917.

Sophol is a silver methylene nucleinic-acid compound and contains 20% silver. Stein (36, **Use of sophol in the prevention of ophthalmia neonatorum**) has used a 5% solution in 5257 cases of the new-born and has observed only two of ophthalmia neonatorum. In one of these the infection did not appear until the eighth day and probably was secondary.

These statistics are extremely favorable as compared with those during the use of nitrate of silver.

Alling.

In three of Wood's (39, **Diagnostic and therapeutic uses of tuberculin in uveitis**) cases a diagnostic injection of tuberculin had a focal reaction which resulted in permanent serious impairment of vision, due to opacities in the vitreous and acute choroiditis. He therefore warns against this danger in cases showing evidence of intraocular activity, but thinks that therapeutic doses should be given well under those required to produce focal reaction.

Alling.

Valois and Rouveix (38, **Prothesis for the one-eyed of the war**) plead for more careful attention on the part of ophthalmologists to this subject. The authors have had to deal with a considerable number of injured soldiers who had their orbital contents more or less completely destroyed, and the introduc-

tion of an artificial eye was impossible. They describe their method of gradual distension of the small irregular space left after severe injuries of the orbit, or hasty enucleations, by the introduction of increasingly larger round or olive-shaped, well polished pieces of hard rubber. In order that the pressure should be exerted in a posterior direction they apply a compressive bandage during the entire course of treatment. The rapidity with which the space between the lids and orbital scar tissue is enlarged is surprising. Furthermore they have succeeded in deepening the conjunctival sac, and even in forming a new one, by the introdution of a dilator shaped like an eye speculum, which by its spring effect exerts a continuous mild pressure, upwards and downwards. Very frequently they used both types of dilators, the round and the speculum-shaped ones. Cases in which cicatricial bands prevent the introduction of any form of dilator have to have these bands carefully dissected out, and replaced by a Thiersch graft on which a dilator is immediately applied to keep it in place. The type of artificial eyes used by the authors differs entirely from that generally known. It consists of an anterior portion of hard rubber, painted to give the appearance of an eye, and a posterior portion of soft rubber, with air between these two parts. This kind of prothesis has the advantage of being elastic posteriorly and responds more readily to the movements of the stump. The appearance is more natural and the unsightly depression above the upper lid, usually seen in patients with prothesis, is not present in those wearing the new type of artificial eyes. (Unfortunately the paper does not describe how these artificial eyes are made, neither does it reproduce photographs of patients wearing these eyes.)

SCHOENBERG.

VALOIS (37, **Remarks on ocular prothesis**) recommends the introduction of a piece of sclera of the enucleated eye between the lips of the conjunctiva in order to secure a more firm stump and greater mobility for the prothesis. After each enucleation he advises the introduction of a piece of rubber, of olivary shape, behind the lids, which controls better the regular formation of the cavity in which the artificial eye is introduced later on. In cases with marked obstruction of the conjunctival sacs by cicatricial bands he uses dilators, made of rubber, of gradu-

ally increasing dimensions, which usually succeed in restoring the space necessary for the introduction of a prothesis.

SCHOENBERG.

COSSE (31, **Ocular prothesis**) gives his experience with 140 cases. It happened very frequently during these times of war that the stock of artificial eyes was exhausted and the author had to use a substitute, made of a material well known to dentists under the name of Crown Composition. It becomes soft when immersed in hot water, can easily be moulded, is well borne by the conjunctiva, and keeps its shape when cooled. The composition is softened by immersion in hot water and introduced into the conjunctival sac in such an amount as to fill up the entire space between the lids and the stump. The surplus is cut away with a knife. The mould is taken out and hardened by throwing it in cold water. On the anterior surface of the mould he paints the pupil, iris, and conjunctival blood-vessels. It often happens that the conjunctiva has been destroyed in part and replaced by cicatricial bands. The mould reproduces the exact configuration of the retropalpebral space and by making it a little larger at the point where the conjunctival sac is obliterated the continuous, gentle pressure restores a groove or makes it deeper, so that the prothesis can be better borne. The author has succeeded in restoring by this method conjunctival sacs which would have otherwise required extensive plastic operations.

SCHOENBERG.

COULOMB and RUPPE (32, **Oculo-palpebral prothesis**) have made an attempt to replace not only the eye but also the lids and the region surrounding the orbit. They found that of all the materials, metal, porcelain, celluloid, gelatine, etc., vulcanized rubber presents superior advantages, on account of its easy handling, color, and lightness. They reproduce a number of photographs of patients with partially or totally destroyed lids and orbital margins, showing how well they succeeded in constructing protheses which defied detection at a distance of even two meters. The authors have employed such means of restoration only in cases in which plastic work had been attempted and had failed, or in which the damage was so extensive that no surgeon wanted to undertake such work.

SCHOENBERG.

LLOYD (35, **The stereoscopic campimeter slate**) has devised a campimeter which combines the advantages of binocular vision as employed by Haitz, and Peter's method of placing the chart at a short distance from the eyes. A stereoscope is used which stands on a table and prevents the unsteadiness when held in the hand. The chart is a slate with crossed lines representing degrees, and covers a field of 10° up and down and 25° laterally. The instrument is used to examine the macular region and the blind spot. ALLING.

DOR (34, **A new universl optometric chart based upon the metric system**) gives a table of mathematical formulas by the aid of which charts consisting of circles superposed upon triangles of various sizes are to be drawn. These drawings could be clearly distinguished by normal eyes, at a distance of various meters, according to their size. The readings are in the metric system and the author has used this new chart, to the exclusion of Snellen's types, in a large number of cases with perfect satisfaction. SCHOENBERG.

CRIDLAND (33, **The tonometer of Schiötz**) has examined 1000 ordinary non-glaucomatous, hospital patients with the Schiötz tonometer with the object of determining the average reading. It was found to be 20.06.

The lowest record was 11.5, the highest 30.

A difference, averaging 2.43, was noted between the two eyes in 21.2% of the patients.

Cridland averages his results with other published figures and gets:

Normal reading 19.58 say 20.

Limits of normality—11.9 to 28.55.

He considers that any reading over 25 should be regarded with suspicion and indicative of glaucoma till further investigation disproves this diagnosis.

The use of the instrument and the precautions necessary to avoid fallacies are discussed.

The records are presented in a table which is cross classified into decades and state of refraction.

T. HARRISON BUTLER.

(*To be continued.*)